From the house of Amar Chitra Katha and Tinkle

# BRAINWAVE™

SCIENCE IS JUST A GAME

Vol. 03 Issue 01
January 2014
48 pages
8-15 years
₹60

## Science of Sports

Science is everywhere!

**Rahul Dravid Interview** p28

p48
Sci-Q time
- win a gift worth Rs. 200!

p24
**Grab your New Year sports exclusive poster**

/brainwavemag
Join 41k other fans

p37 **Web-only Content**
The cricket song & more

p46 Treasure Hunt
Win cool books from
LEAD START Publishing

p30 **Fan Fiction**
Win an Turbo DVD by Dreamworks and Excel Home Entertainment!

Brainwave Science Magazine simplifies textbook science for 8-15 year olds. It makes lessons interesting by presenting them in the form of comics, stories, DIYs, fascinating facts, contests and much more. Grab your copy now! For subscription, turn to page 47.

AD

# BEHIND THE SCENE

THE 'TIME TRAVELLING KUMARS' HAS ITS FANS. THE ENTRY OF SHERLOCK HOLMES HAS ONLY MADE IT INTERESTING. WE NOW REVEAL HOW IT IS DONE! HERE COME SOME SUPER EXCLUSIVE SH-BEHIND-THE-SCENES.

*Artwork: Sarthak Sinha*

What do you think about our 'Behind the Scene' snippets? What more would you like to know? Shoot out an email to brainwave@ack-media.com

Cover artwork by **Saudamini Tambay**

No part of this magazine may be reproduced without the express consent of Amar Chitra Katha Private Limited (ACK). Any reproduction, modification, distribution, transmission, republication, display or exploitation in any way of the content(s), in whole or in part, of this magazine is strictly prohibited. ACK makes no warranties or guarantees, express or implied, written or oral, as to the contents of the magazine, the information, materials or opinions, included in this magazine. In no event shall ACK be liable for damages of any kind arising as a consequence of using or following any method or formula as mentioned in the magazine, including but not limited to direct, indirect, incidental, punitive and consequential damages.

**Consumer Complaints:**
+91-22-6629 6999
customerservice@ack-media.com

**Business Queries & Customer Service Escalations:**
sasikanth.c@ack-media.com

**Ad-sales:**
advertisingsales@ack-media.com

**Credits:**
Abbas, Avinash & Ellie
Carisa R & Jayanthi V
Eric D'souza & team
Heta D & Shilpi M
India Book House & team
Janak F, Yogesh G & team
K.K. Arun & team
Lalit S & team
Mayur S & team
Narayan M & Rajesh Pathak
Prakash B, Sandya J & team
Sagar S & Shrikant W
Sandeep S & team
Swati Gupta & team

**Senior VP Operations**
Sandeep Padoshi

**Digital Business Head**
Shubhadeep Bhattacharya

BRAINWAVE™
Vol. 03 | Issue 1 | January 2014

**Editor & General Manager**
Sasikanth C

**Consulting Art Director**
Savio Mascarenhas

**Assistant Editor**
Priyanka Talreja

**Design Lead**
Ria Rajan

**Designer & Illustrator**
Saudamini Tambay

**Junior Illustrator**
Jeenal Patel

**Resident Geek**
Pushkar Samant

**Creative Writer**
Joanne Carlo

**Advisory Board**
Arvind Gupta
*Scientist & Educator*
AS Manekar, *Director*
*Nehru Science Centre, Mumbai*
Hari Parameswaran
*Scientist & Educator*
Dr. Chandrakant Shukre
*Astrophysicist*
Maya Menon, *Director*
*The Teacher Foundation*
Geetha Narayanan, *Director*
*Srishti School of Art, Design & Technology*
Dr. Balaji Sampath
*Aid India Foundation*
Siddharth Rao, *Director*
*Agumbe Rainforest Research Station*

**Subscriptions:**
brainwave@ack-media.com

**Brainwave is Printed and Published by** Vijay Sampath **on behalf of** Amar Chitra Katha Private Limited **Printed at** Indigo Press (India) Pvt. Ltd., Plot No. 1, C/716, Opp. Dadoji Konddeo Cross Road, Byculla (E), Mumbai 400027 **Published at** Krishna House, 3rd Floor, Raghuvanshi Mills Compound, Senapati Bapat Marg, Lower Parel (West), Mumbai 400013.

Copyright © 2014, Amar Chitra Katha Private Limited. All rights reserved.

Vol. 03 | Issue 01 | January 2014

# BRAINWAVE™

# CONTENTS

## A FIELD DAY

■ ✚

COVER STORY

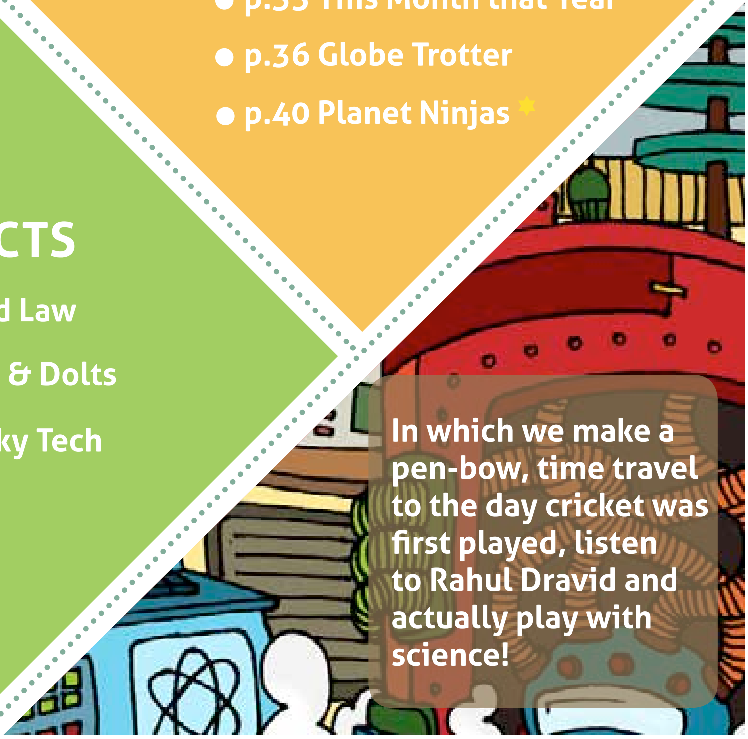
12

## KNOW IT ALL

■ ✚ p.11 Flash News
● p.22 Ask us Why
● p.35 This Month that Year
● p.36 Globe Trotter
● p.40 Planet Ninjas ★

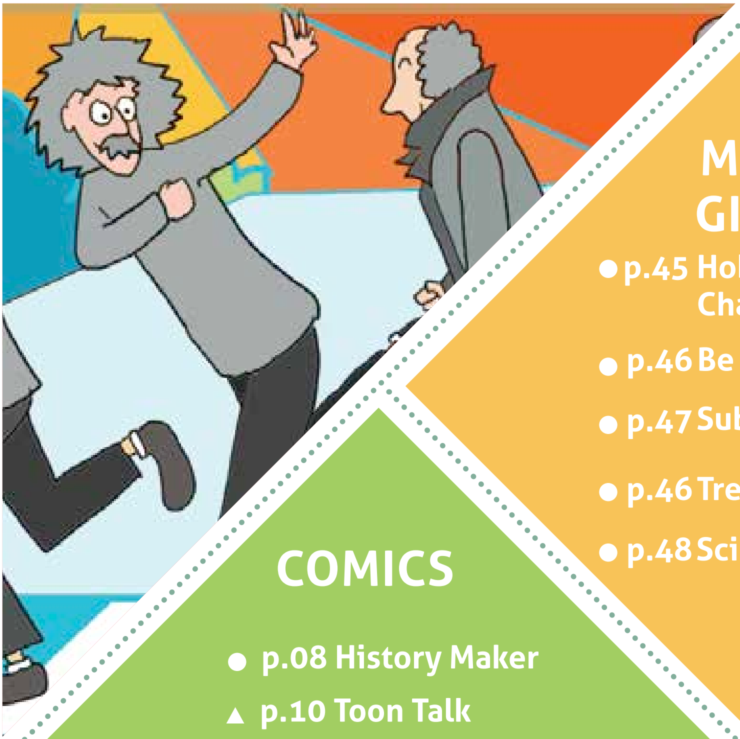
## FUN FACTS

● p.27 Third Law
● p.32 Nuts & Dolts
● p.41 Wacky Tech



In which we make a pen-bow, time travel to the day cricket was first played, listen to Rahul Dravid and actually play with science!

Aptitude guide: ▲ Beginner ■ Medium ✚ Advanced ● Common



## MORE GIFTS!

● p.45 Hobby Ideas Challenge ★
● p.46 Be a Smartenstein ★
● p.47 Subscription Form ★
● p.46 Treasure Hunt ★
● p.48 Sci-Q Quiz! ★

## COMICS

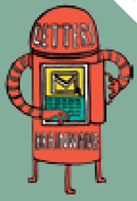
● p.08 History Maker
▲ p.10 Toon Talk
■ ✚ p.18 Science Fiction
✚ p.38 Multiverse
▲ ■ p.42 The Smarties

## SPECIALS

p.24 Poster
● p.28 Expert Talk

## FUN-DO AND LEARN

■ p.06 Toybox ★
▲ p.33 Eye See ★
■ p.44 DIY ★
▲ ■ p.37 Magic Science ★



## READERS' EXCLUSIVE

● p.30 Fan Fiction ★
● p.31 Letters From Readers
● p.31 Solutions & Winners

# MEET THE SMARTIES

Beyond the skies, trouble brews.
Danger awaits us, all humans!
Sneaking and lurking in the dark,
Someone's plotting to tear humanity apart.

Much before they act, our friends arrive to
thwart the attack,
1... 2... 3... Go! The Smarties arrive fast.
Yes they are here, look!

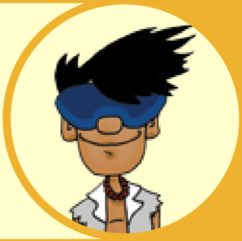
The Smarties rarely punch down opponents -
they are peace lovers.
They use not only brawn, but also brains!

The battle's won; let us meet them now,
They are real heroes - take a bow!

Dr. Dodo, dear friends,
is the only Dodo alive.
The wise elderly scientist,
his ideas save many a life!

Skree! is mysterious,
a bearded Toda lady.
Up her sleeves,
she has tricks aplenty!

Young Arby is the great
Indian mathematician.
Sucked into BW Labs by
Dr. Dodo's time-machine,
Grow up to be Aryabhata,
yes he will fine!



Young Alby's none other
than Albert Einstein.
Sucked in time by
Dr. Dodo's Galileo one,
He will soon change the
history of science!

Mr. X is the antagonist,
Top IQ of the universe is his!
Opposing ideology than the
Smarties,
Is he good? Is he bad? You
analyze.

Earth, wind, water and fire
combine to make
Bhoo - an enigma,
She is a superhero -
every villain's dilemma.

Now that you know them, see their wonders,
The episode begins, the Earth's saved
from plunder.

*www.bwmag.in/meet-the-smarties*

BRAINWAVE

# SCIENCE ISN'T EVERYTHING, BUT EVERYTHING IS SCIENCE!

Artwork: Jeenal Patel

Friends, this issue is actually supposed to be the third part of our technology series. But we couldn't resist the temptation of giving you a much deserved new year surprise. So, here it is - the sports issue with some great additions - the Smarties hymn, the cricket song, Rahul Dravid's interview, science 'fun'das of the balls used in various sports and a cool 2014 sports exclusive poster - amongst other things.

We all love sports. Of course, who doesn't! But, have you ever thought of the science behind it? It is not just about the physics involved in the way each game is played. It is also about biology and chemistry - diet, nutrition, fitness, stamina and concentration.

In his interview, Rahul Dravid says, "I would have never guessed how important some of the concepts I learnt in physics or biology class would become to my understanding of my sport." With that in mind, recall how we always say that science is just a game? This issue is the best testimony of that. Play on! ■

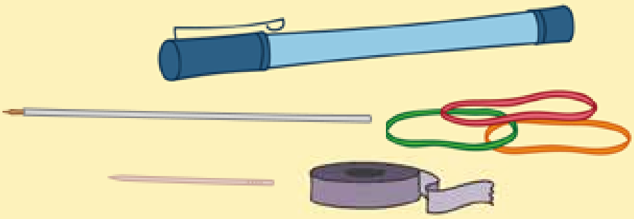
An easy tongue twister this time - *Purple paper people.* Repeat 20 times in a minute.

**- Sasikanth C**

# Shoot it!

by **Pushkar Samant**

*Let's make a simple pen-bow. But, let's not use it against any human or animal.*

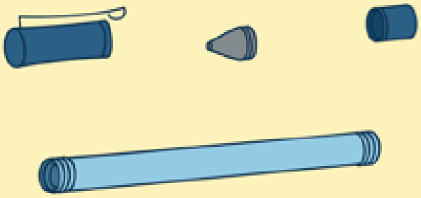


## You need:

- A pen
- 3 rubber bands
- An empty refill or toothpick
- A tape

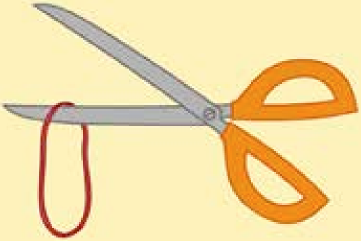
## Method:

### Step 1



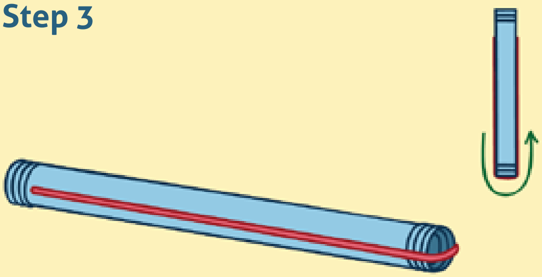
Dismantle the pen. We will use only the body. It has two open ends.

### Step 2



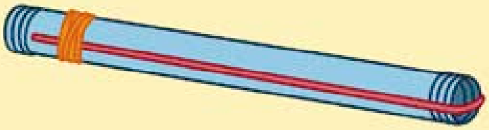
Take a rubber band and cut it.

### Step 3



Stretch the cut rubber band around the pen vertically, as shown in the image.

### Step 4

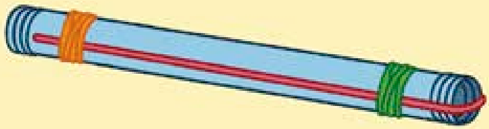


Take another rubber band and wrap it around one of the ends of the pen, until it holds the vertical band tightly in place.

Artwork: Jeenal Patel

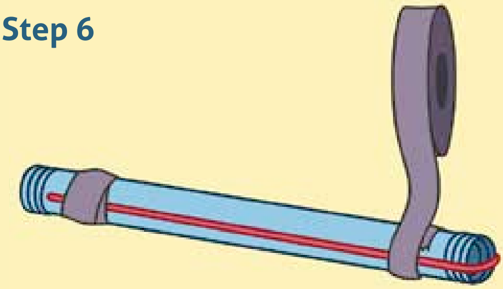
Watch the video at: *www.bwmag.in/jan2014videos*

## Step 5



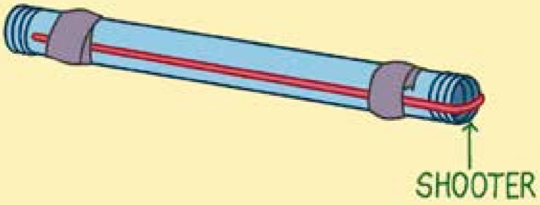
Repeat step 4 with the third rubber band. Wrap it around the other end of the pen.

## Step 6



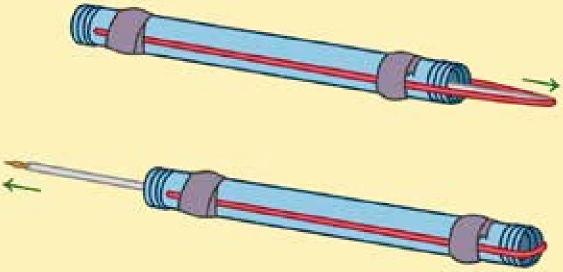
Make the structure strong by wrapping tape tightly on the second and third rubber bands.

## Step 7



Now, one end of the pen will be completely open and other end will have a rubber band running across it. This is the the string of your pen-bow.

## Step 8



Place an empty refill or a big enough toothpick in the pen, through the open end. Hold the bottom end of the refill and the part of the rubber band running across it, stretch them and shoot, as shown.

**Your simple pen-bow is ready!**

## What do we observe?

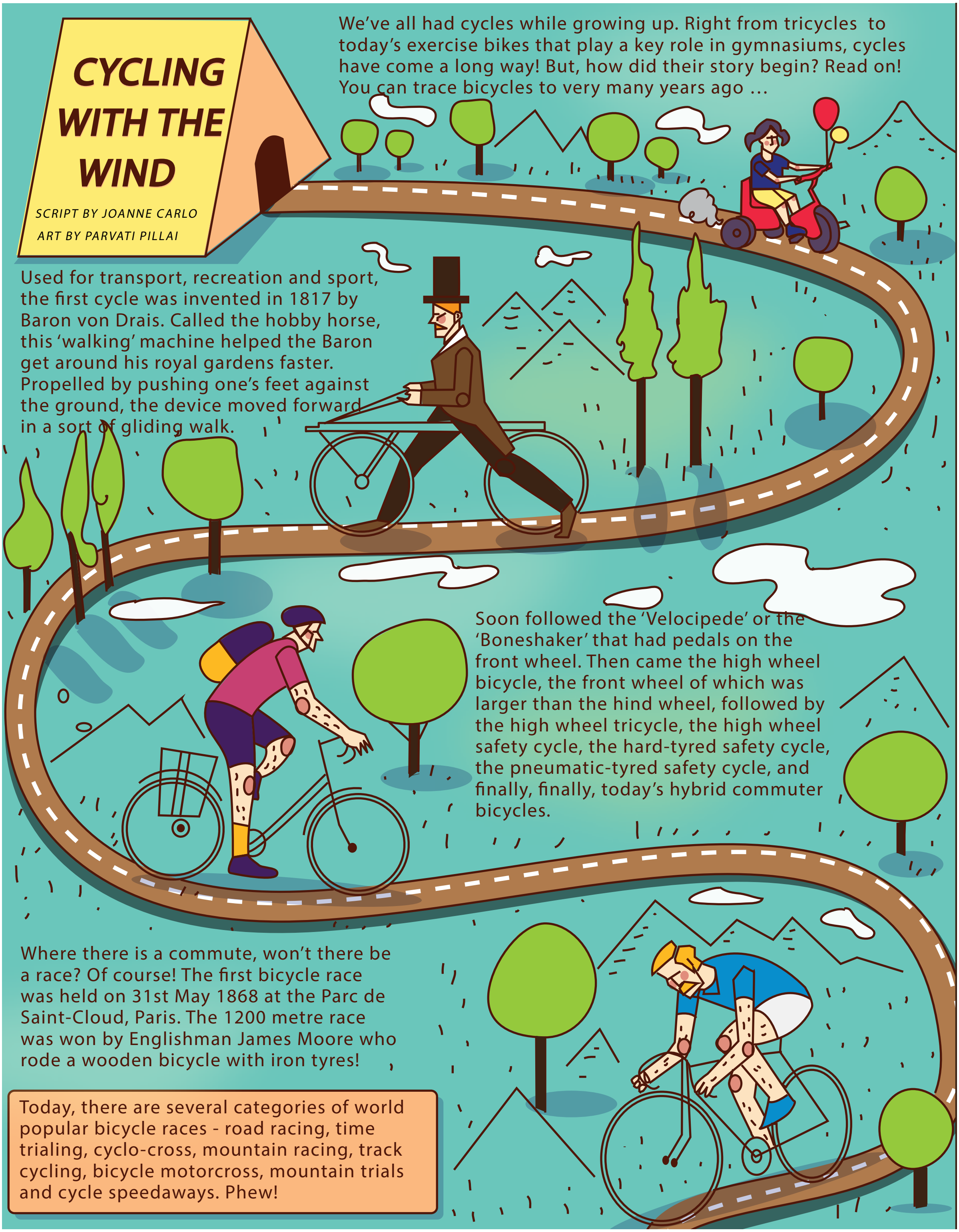
The stretched rubber band contains potential energy. When we release it, its potential energy is converted into kinetic energy, which pushes the refill out with a great force.

What would happen if we used a regular twine or thread instead of a rubber band? Why?

Research and email your answer to *brainwave@ack-media.com*
The best answer wins a cool ACK comic book!

# CYCLING WITH THE WIND

SCRIPT BY JOANNE CARLO
ART BY PARVATI PILLAI



We've all had cycles while growing up. Right from tricycles to today's exercise bikes that play a key role in gymnasiums, cycles have come a long way! But, how did their story begin? Read on! You can trace bicycles to very many years ago …

Used for transport, recreation and sport, the first cycle was invented in 1817 by Baron von Drais. Called the hobby horse, this 'walking' machine helped the Baron get around his royal gardens faster. Propelled by pushing one's feet against the ground, the device moved forward in a sort of gliding walk.

Soon followed the 'Velocipede' or the 'Boneshaker' that had pedals on the front wheel. Then came the high wheel bicycle, the front wheel of which was larger than the hind wheel, followed by the high wheel tricycle, the high wheel safety cycle, the hard-tyred safety cycle, the pneumatic-tyred safety cycle, and finally, finally, today's hybrid commuter bicycles.

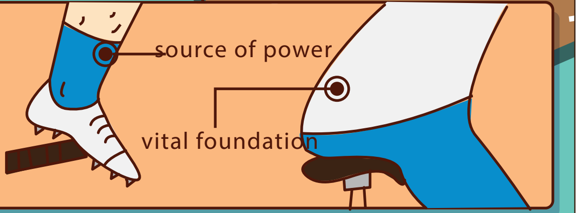
Where there is a commute, won't there be a race? Of course! The first bicycle race was held on 31st May 1868 at the Parc de Saint-Cloud, Paris. The 1200 metre race was won by Englishman James Moore who rode a wooden bicycle with iron tyres!

Today, there are several categories of world popular bicycle races - road racing, time trialing, cyclo-cross, mountain racing, track cycling, bicycle motorcross, mountain trials and cycle speedaways. Phew!

Since it's conception, cycling has undergone a number of changes. Science made us understand aerodynamics better and has changed bicycle design, clothing and ergonomics.

These three factors – design, clothing and position - correlate to the amount of drag experienced by the cyclist. Which is why you see cyclists dressed in sleek, close-fitting clothes. They optimize the aerodynamics and help finish the race faster!

Of course, it's not just those three factors. It's about the endurance of the cyclist as well. The cyclist's legs are the source of power, while the abs and lower back are the vital foundation from which all movement, including the pedal stroke, stems. To develop stability, right exercise is essential.

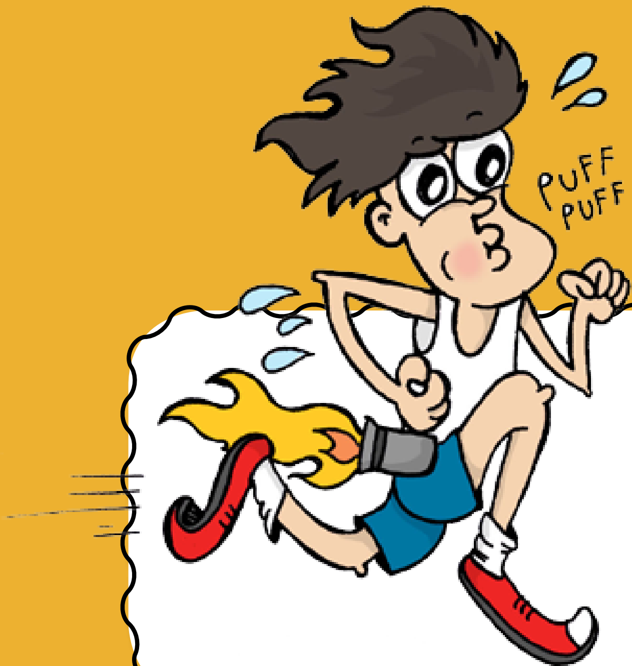


The boxer ball crunch, power bridge, hip extention, plank, transverse plank, scissors click, catapult and boat are some of the training exercises that help make a better cyclist. But let's not forget the need of hi-tech tracks. Just like footballers need spiked shoes, cyclists need specially built banked tracks.

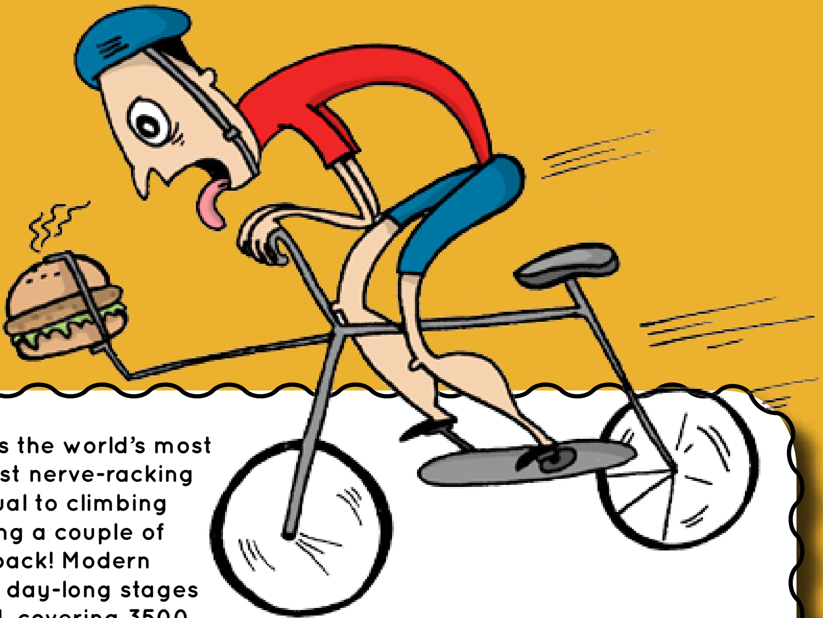
But where does all this training lead to? Major cycling competitive events, of course! These include the Olympic Games, Union Cycliste Internationale (UCI) Track Cycling Championships, UCI Track Cycling World Cup Classics and UCI Track Cycling World Ranking.

So, be all set for the UCI Track Cycling Championship. It's on at Cali, Columbia from 26th February, 2014. Ready, set, go!

Did you know? The Wright brothers operated bike repair, rental and sales shops in Dayton, Ohio.



As of now, it is impossible to travel faster than the speed of light, and certainly not desirable, as one's hair would get messy.



The Tour de France is the world's most adventurous and most nerve-racking bicycle race. It is equal to climbing 3 Everests and running a couple of marathons back-to-back! Modern editions consist of 21 day-long stages over a 23-day period, covering 3500 Kms. Athletes burn about 7000 calories a day!

Artwork: Alicia Souza

## The Betaine Boost

Scientists have now found that Betaine – a nutrient found in shellfish and beetroot is capable of boosting athletic performance by nearly 6 percent when added to a sports drink.

The researchers came to this conclusion after sixteen college-aged cyclists were tested multiple times in order to measure how sports drinks and betaine beverage affected performance. The cyclists were made to consume only a commercial sports drink in the first few weeks of research, and only betaine in the last few. Betaine supplementation increased the athlete's power by 6 percent.

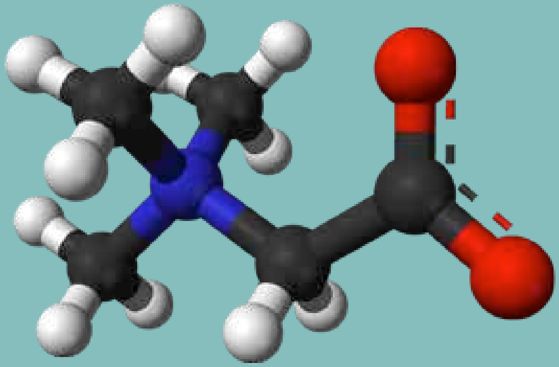


*Image Source: Wikimedia Commons*

Researchers say that further studies can clarify the mechanism of how betaine supplementation improves performance in athletes. *Source: Science Daily*

## Specialisation - not the way to go?

John P. DiFiori, President of the American Medical Society for Sports Medicine believes that specializing in a particular sport from a young age is not the way to go.

He reveals that few who specialize in one sport at a very young age make it to the elite level. He says, "With the exception of select sports such as gymnastics, in which the elite competitors are very young, the best data we have suggests that the odds of achieving elite levels with this approach are exceedingly poor."

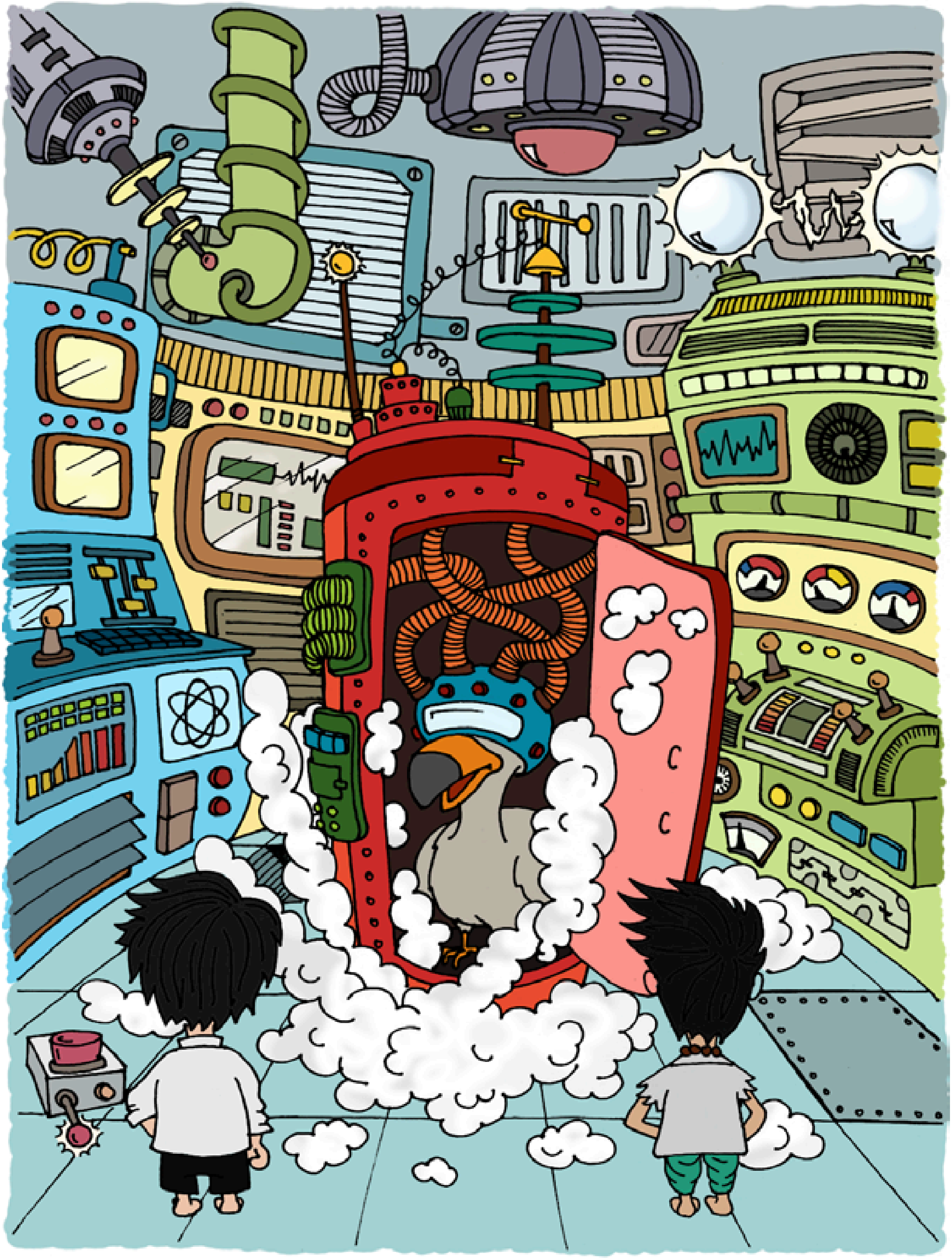
Dr. DiFiori appreciates the benefits of sports participation in general - increased self-esteem, self-discipline, development of leadership qualities, better motor skills$^{G}$, and overall health and well-being. But he warns that external pressure on a child to train and compete in one sport at an early age may cause social isolation, lack of independence, preferential treatment, burnout and injuries.
*Source: Science Daily*

## Quick weight loss for combat sport results in dehydration

It has been observed that athletes in combat sports often try to shed body weight in order to compete against lighter and smaller opponents. But, a new thesis$^{G}$ from the University of Gothenburg points to the human body's limited ability to quickly recover from extensive short-term weight loss.

The thesis found that almost half of the studied athletes were severely dehydrated on the morning of their matches. Nevertheless, the athletes seem to focus on the mental advantages of the method.

These results now point out the ill effects of extensive short-term weight loss and show that many people involved in combat sports need to be made aware of the problems, including athletes, coaches, nutritionists, and sports psychologists. Furthermore, the international federations for the respective sports should seriously consider revising their rulebooks. *Source: Science Daily*



Artwork: Jeenal Patel

# A Field Day

by **Priyanka Talreja & Sasikanth C**

*On a fine bright day, Dr. Dodo surprises Alby and Arby with a cool thought - travel in the Galileo time machine to witness a key moment in the history of Cricket. Read on to find out what that is!*

It was a lazy day at the cave. Everything was peaceful and the Smarties were taking it easy. Bhoo and Skree! were grooming themselves. While Skree! meditated, Bhoo combed out the knots formed in her hair due to all the flying and teleporting. The boys were thoroughly bored.

Walking about the cave aimlessly, the boys landed up in Dr. Dodo's lab. When they entered, they saw that Dr. Dodo was no where to be seen! This was surprising to them. Dr. Dodo was always in his lab. Always.

Soon, a haze appeared in a corner of the lab. Bit-by-bit, Dr. Dodo appeared out of thin air. Dr. Dodo had gone time travelling! That too, all alone.

Dr. Dodo stepped out of the machine. "Afternoon boys, I am glad you are here. I was just about to come looking for you. Come on, I have planned something cool for us to do. This is officially the BW guys' day out!"

"Oh great!" exclaimed Alby, "I am glad you have planned something for us, Dr. Dodo. Let's go." And with that, the boys stepped into the machine. Dr. Dodo keyed in a year and the machine shook – softly at first and vigorously soon after. Another journey had begun.

"Where to, Dr. Dodo?" asked Arby eagerly.

"We shall soon be there Arby," Dr. Dodo said, with a sly smile.

*Swisshh*! There was a loud sound and the machine halted. Arby peeked into the control panel and noticed that the year was 1611 and the place was Sussex, a historic county in South East England.

The boys stepped out of the machine and saw two men at a distance. They seemed to be playing cricket.

"What's happening here, Dr. Dodo?" questioned Alby.

"Well boys, the moment you see right in front of your eyes is a historic one! This is the first ever reference to cricket being played as an adult sport."

"Oh, that's great!" exclaimed Alby.

Dr. Dodo continued, "But that is not the only reason why I brought you here, boys."

"What's on your mind, Dr. Dodo?" quizzed Arby, enthusiastically.

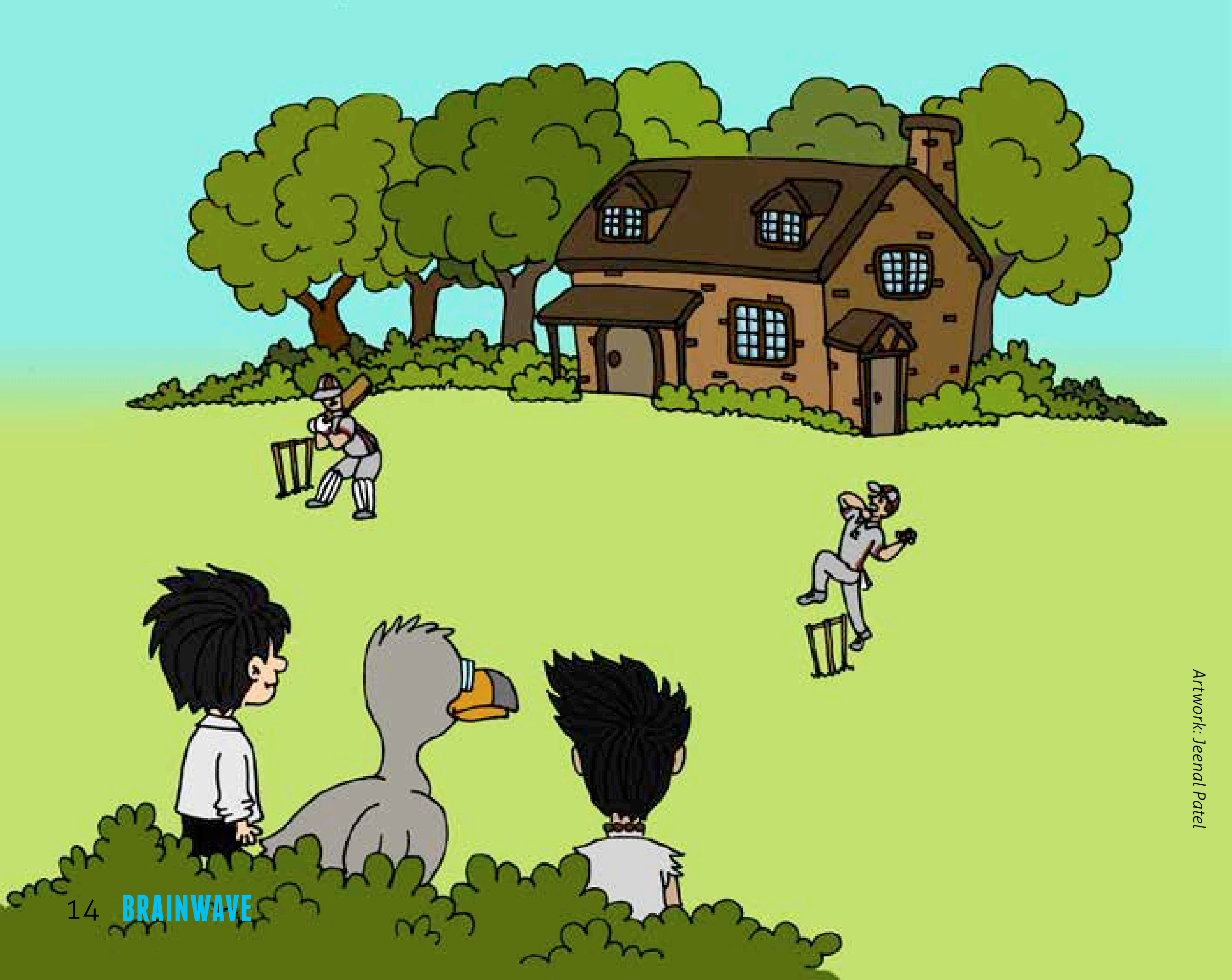
"I want you kids to observe the science behind this sport. It will help you with your studies as well as cricket practice. Let's learn through a simple observation game. What do you see?"

Both Alby and Arby fell silent. They observed the two men in a complete different light this time. They soon started identifying the various science concepts being used in the game of cricket.

“For one, while the man is bowling, he is using the concept of force,” said Arby.

“That is a great start, Arby. And there's a lot more to it,” explained Dr. Dodo. "If you look closely, the air around the ball plays a crucial role. The friction caused by the air affects the speed at which the ball is bowled. It also causes the ball to curve or swing away from the path it would otherwise follow.

Let’s say that this ball is bowled horizontally at 123 kmph. In such a case, it experiences a backwards horizontal drag equal to the weight of the ball, which is 160 gm. Due to this drag, if the ball leaves the hand of the bowler at 150 kmph, it reaches the batsman only at about 85 kmph."



Artwork: Jeenal Patel

"That's a good concept to know. I will keep it mind the next time I play. Depending on the air resistance and speed of the pitch, I will vary the angle of at which I release the ball and the angle of incidence between the ball and the pitch - to retain as much pace as possible," said Arby.

"Back to the science I observe in here, the batsman is using energy to hit the ball that is bowled at him," he continued.

"That's great Arby! Tell me, to hit the ball as far as possible, should the batsman use a heavy bat or should he use a lighter bat?" questioned Dr. Dodo.

"Easy question! A heavy bat has more momentum and hence, more energy. So, it would pack more power," answered Alby, with a triumphant grin.

"But the momentum of the bad depends on the pace at which you swing the bat. Light bats could be swung faster than the heavy ones, making the weight of the bat less relevant. Isn't it?" countered Dr. Dodo.

"Right. So, a heavy bat is not a good choice unless the batsman can consistently swing it at the same speed as he would swing a ligher bat at. But, he would be at a disadvantage in situations where he has to move into position and move the bat quickly," concluded Alby.

"Dr. Dodo, there is so much science involved in cricket. Let us discuss fielding too!" Arby added.

"Okay, let us talk about wicket keeping. It is a very crucial aspect of fielding. For the wicket keeper to move to his right in split seconds to catch a ball, which foot should he move first? And in what direction?"

"It is obvious that his right foot should move to the right while the left foot stays on the ground and digs as hard as possible to the left. That way, his whole body moves rapidly to the right," answered Arby.

That is right. But, a wicket keeper often has only a fraction of a second to react and catch the ball. In such cases, he should dig to the left with his left foot, and move his right foot to the left first and then, to the right. That way, he will tend to fall over to the right and hence, his upper body moves even faster to the right. This is called a gravity-step[G] and is counter-intuitive.

High speed films show that players who move their right foot to the left before moving it to the right, get to the ball faster. The physics explanation is that bringing the feet together reduces the moment of inertia, causing the upper body to almost fall and rotate faster. The same is applicable when a diver has to do a double or triple somersault. Tucking the arms and legs in reduces the moment of inertia and the diver spins faster," briefed Dr. Dodo.

Just then, they saw two policemen arrest the players and take them away!

"Huh? What just happened, Dr. Dodo?" asked Alby, confused. Arby was equally puzzled.

"Well, this is the most interesting part of the story, boys. The men are being prosecuted for playing cricket on a Sunday, instead of going to church!" ■

# Bouncing balls

by **Priyanka Talreja**

*While the balls were bouncing away, making most of the sports in the world worth watching, we asked them to stop dead in their tracks. An important task needed to be done - we had to interview them about how science lets them perform superbly!*

1

## Rugby ball

*TThe first sports ball we decided to interview was the Mr. Rugby ball – due to his unique egg-like shape. Slightly snooty, Mr. Rugby Ball was very interesting to talk to.*

BW: Mr. Rugby Ball, please tell us about your egg-like shape? That's the first thing everyone notices.

**Mr. Rugby ball:** I should be out on the field! You guys are just wasting my time. For your kind information, my shape is not egg-like. It's 'oblong', for god's sake! For the last time, I am going to tell you the reason why I am shaped this way. I am oblong because, that way:

- I am easier to hold and offer better grip
- I am easier to pass
- I fit under the arm, so I am easier to run with
- I don't roll too far

BW: But, what about your pointed ends?

**Mr. Rugby ball:** Duh! The main reason for my pointed ends is 'aerodynamics'. Often, players need to throw me far or pass me. My pointed ends help me pierce through air and maintain the trajectory. That's about that. I'd like to go now. I have a game to play … *sweep!*

Did you know that traditionally Rugby balls were made of brown leather? But, the modern Rugby balls are also made of suitable synthetic material and manufactured in a variety of colors and patterns. A regular ball is 28–30 centimeter long, has a circumference of 58–62 at its widest point and weighs 410–460 gram.

2

## Tennis ball

*Next on our list was the sprightly, ever-excited Ms. Tennis ball. Constantly jumping around, she had a lot to say.*

Did you know where the 15-30-40 way of scoring tennis games comes from? One theory is that it represents the minutes in an hour. Also, the word 'love' for zero comes from the French l'oeuf, an egg.

*Artwork: Kashmira Sarode*

BW: Hello Ms. Tennis ball. Please tell us something about yourself?

**Ms. Tennis Ball:** I love to bounce!

BW: Err ... yes, we can see that. But what we want to know is why you are so jumpy always?

**Ms. Tennis Ball:** Well, that is because I am hollow! An air-filled ball like me is lighter than a solid rubber one and hence, has many advantages. Also, there are three major categories of tennis balls, each designed for specific use on set court types, to speed up or slow down play.

BW: That's great! But why do you have that fur on you?

**Ms. Tennis Ball:** Hehehe ... That's not fur. That is fibrous felt which modifies my aerodynamic properties. In simple terms, the felt ensures more friction with the ground or the racket than a smooth ball. It also helps me grab the court more than a smooth ball so that topspin, backspin, and sidespin can be more effective when I bounce off the ground.

And now, I am off!

*Bounce ... bounce ... bounce ...*

3

## Cricket Ball

*The third on our list was the strong headed Mr. Cricket ball. Stern and to the point, he was a complete no-nonsense person.*

BW: Dear Mr. Cricket ball, please tell us what makes you so strong and hard?

**Mr. Cricket ball:** My core is made of cork. This helps us cricket balls bounce as much as we do. The cork is wound in layers of twine and wrapped in red leather. The leather is held together with a raised seam of six rows of stitching that gives the ball a number of unique aerodynamic qualities that help determine its swing, cut and spin.

My mass helps me move with great velocity. So, if you do not know how to handle me, you must move away when I am thrown towards you!

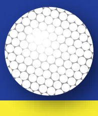
BW: That's awesome! But, why red?

**Mr. Cricket Ball:** Aah, my colour! Well, cricket originated in England, where light levels are low. You know that light is made of seven different colors, right? The red wavelength is scattered least from its original path and hence, red colour is most suitable for spotting in dwindling light.

For a very long time red was the only colour I was made in. Then, day and night cricket matches were introduced and folks had to make me in white for better visibility against coloured clothing and in nights. Hey, got to hit the pitch. See you sometime later.

*Smackkkkkkkk!*

4



## Golf Ball

*Last, but not the least on our list was Master. Golf Ball. He was charming and chose his words carefully. His dimples caught our eye.*

BW: Hello, charming Master. Golf ball, please tell us about your dimples.

**Master. Golf Ball:** Sure. They are charming, aren't they? Here's the secret behind them - the dimples make the air-flow around me turbulent. This means that when I fly to reach the put, the drag is reduced and I can travel a longer distance. To get a little more technical, my dimples are all about boundary layer and lift. The dimples aid the rapid formation of a turbulent boundary layer around me when I am in flight, giving more lift.

Now, I am in a slight rush. I have 7 more holes to catch! Nice meeting you.

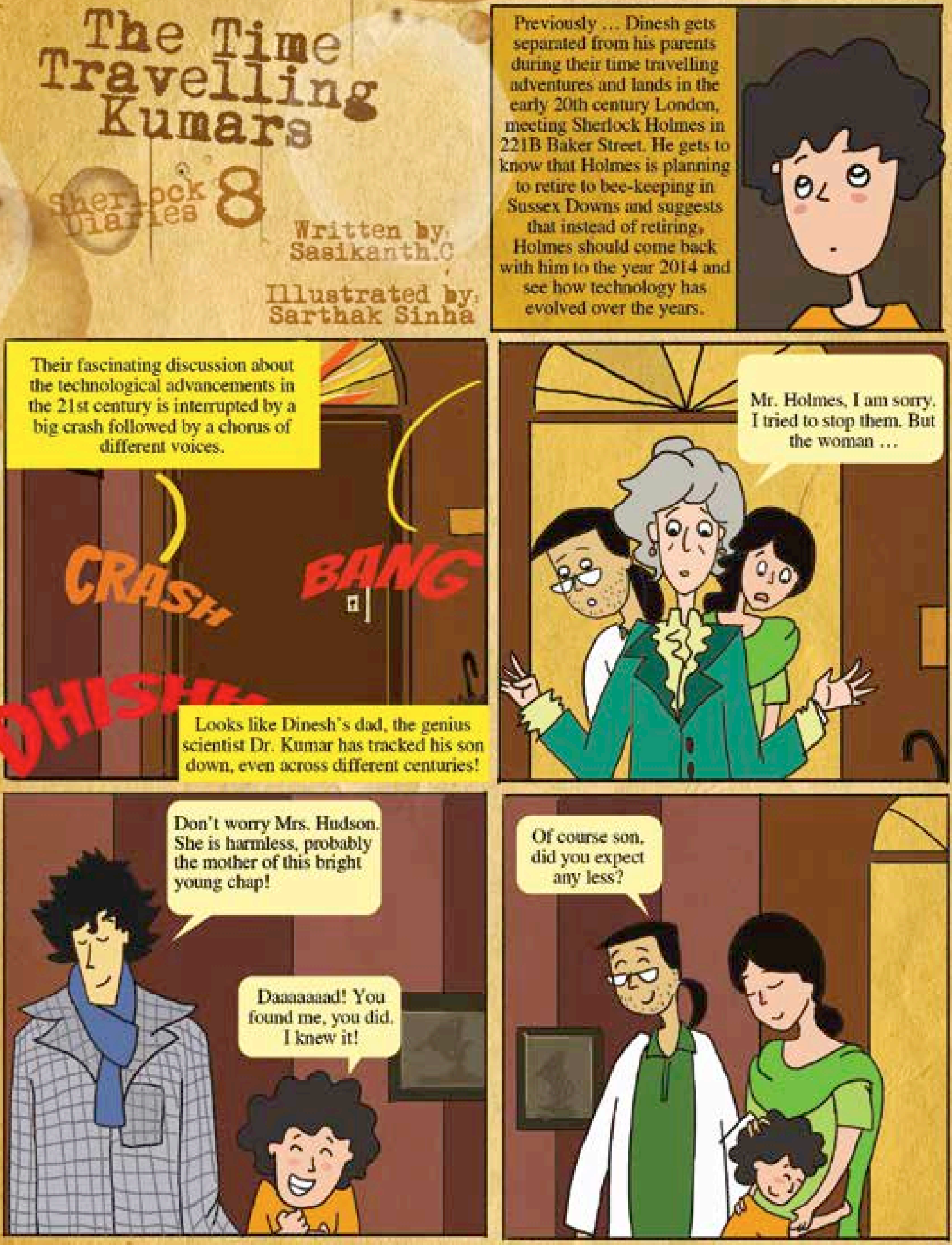
Swishhhhhhhhhhhhhhhhh!

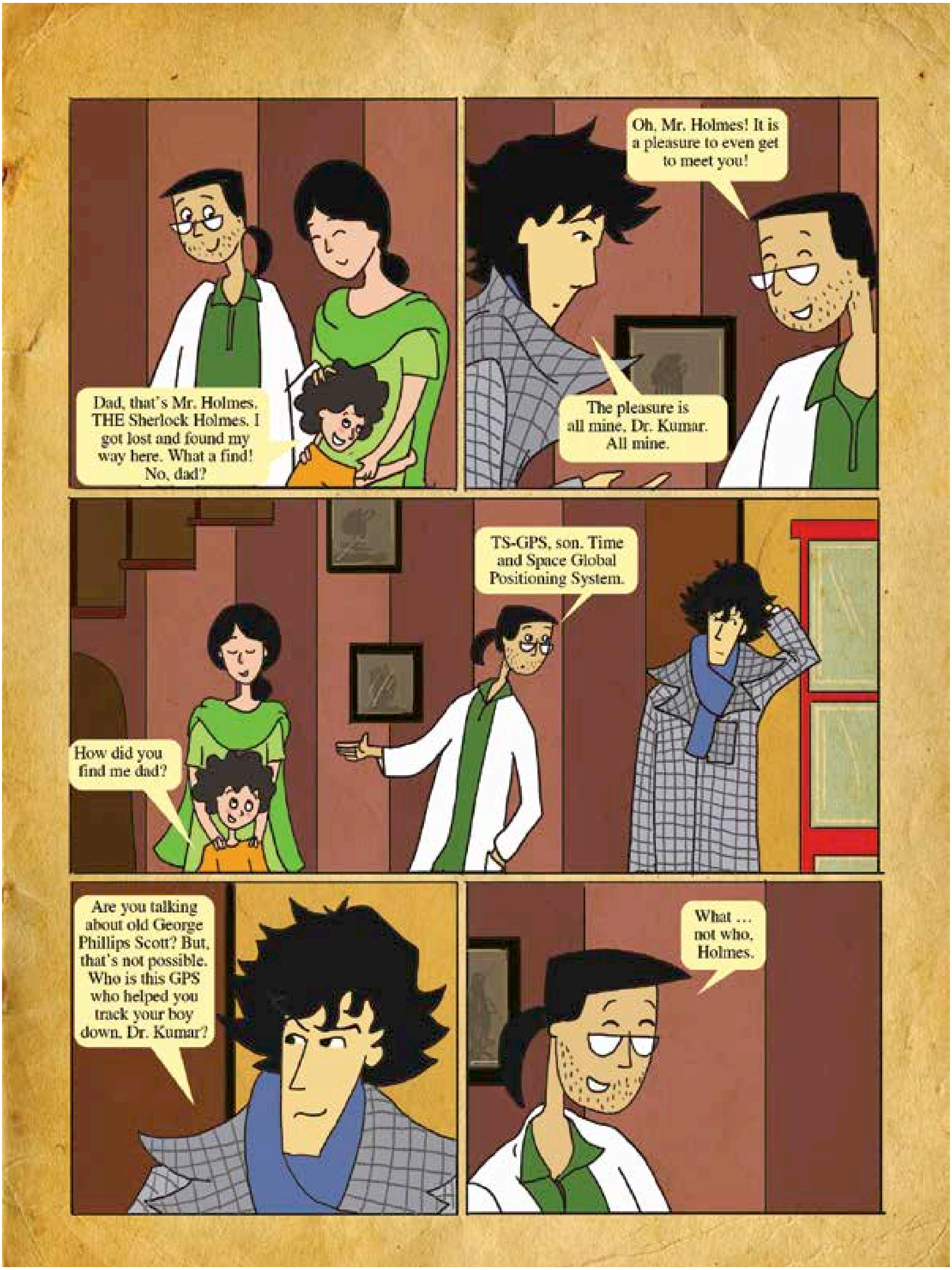
# The Time Travelling Kumars

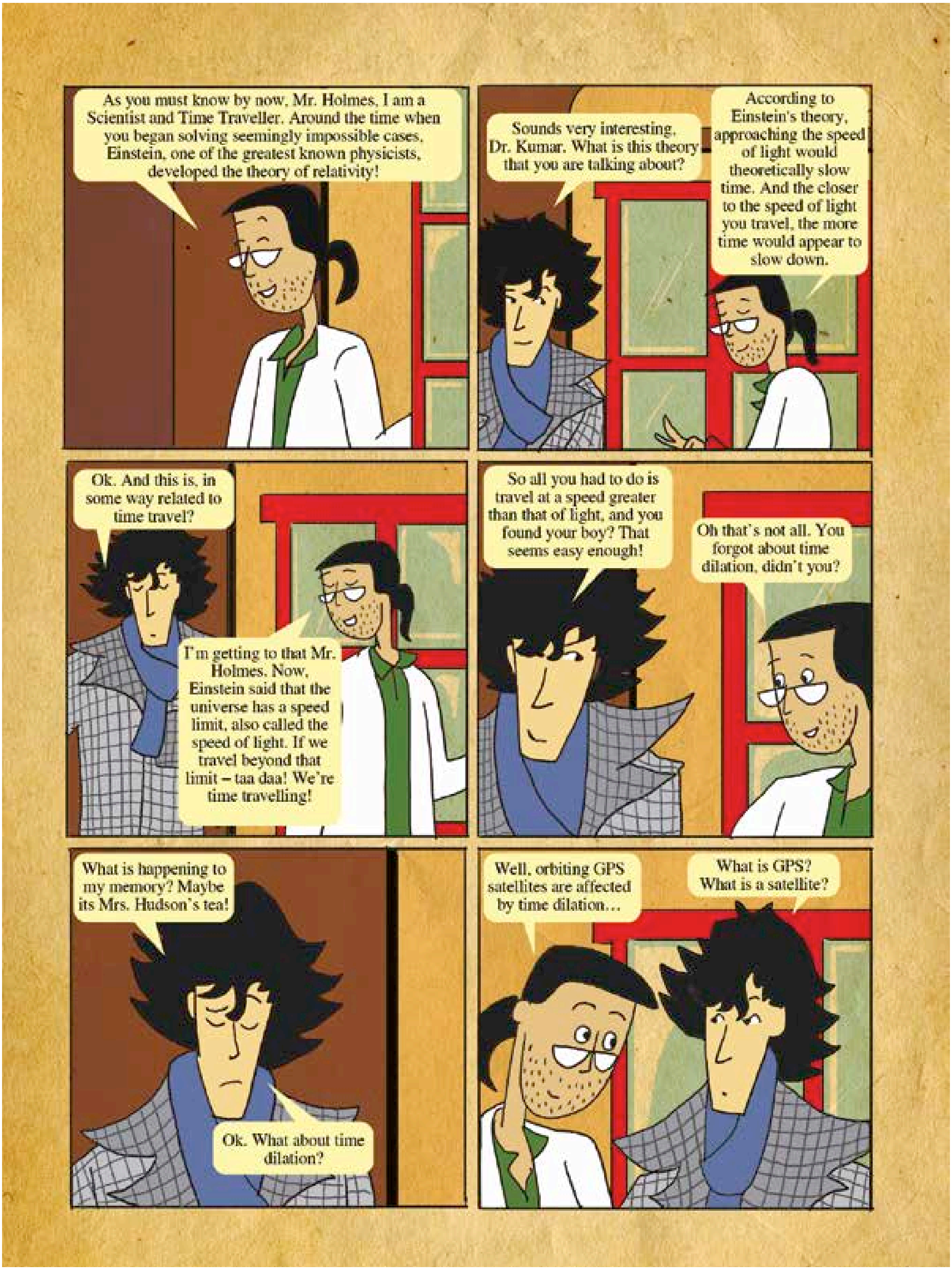
## Sherlock Diaries 8

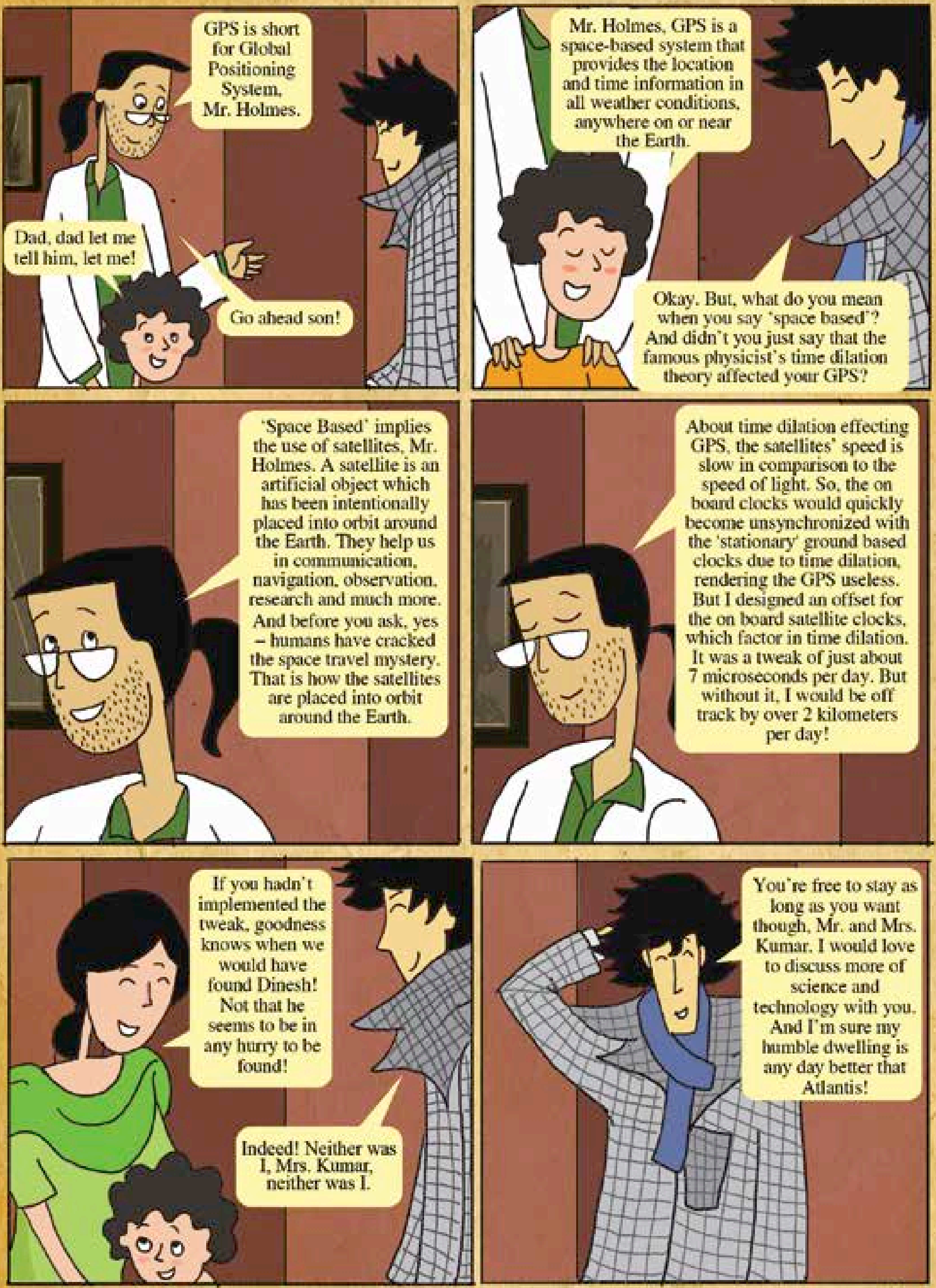
Written by: Sasikanth.C

Illustrated by: Sarthak Sinha


Previously … Dinesh gets separated from his parents during their time travelling adventures and lands in the early 20th century London, meeting Sherlock Holmes in 221B Baker Street. He gets to know that Holmes is planning to retire to bee-keeping in Sussex Downs and suggests that instead of retiring, Holmes should come back with him to the year 2014 and see how technology has evolved over the years.
Their fascinating discussion about the technological advancements in the 21st century is interrupted by a big crash followed by a chorus of different voices.
CRASH
BANG
DHISH
Looks like Dinesh's dad, the genius scientist Dr. Kumar has tracked his son down, even across different centuries!
Mr. Holmes, I am sorry. I tried to stop them. But the woman …
Don't worry Mrs. Hudson. She is harmless, probably the mother of this bright young chap!
Daaaaaaad! You found me, you did. I knew it!
Of course son, did you expect any less?


Dad, that's Mr. Holmes. THE Sherlock Holmes. I got lost and found my way here. What a find! No, dad?
Oh, Mr. Holmes! It is a pleasure to even get to meet you!
The pleasure is all mine, Dr. Kumar. All mine.
TS-GPS, son. Time and Space Global Positioning System.
How did you find me dad?
Are you talking about old George Phillips Scott? But, that's not possible. Who is this GPS who helped you track your boy down, Dr. Kumar?
What ... not who, Holmes.


As you must know by now, Mr. Holmes, I am a Scientist and Time Traveller. Around the time when you began solving seemingly impossible cases, Einstein, one of the greatest known physicists, developed the theory of relativity!
Sounds very interesting, Dr. Kumar. What is this theory that you are talking about?
According to Einstein's theory, approaching the speed of light would theoretically slow time. And the closer to the speed of light you travel, the more time would appear to slow down.
Ok. And this is, in some way related to time travel?
I'm getting to that Mr. Holmes. Now, Einstein said that the universe has a speed limit, also called the speed of light. If we travel beyond that limit – taa daa! We're time travelling!
So all you had to do is travel at a speed greater than that of light, and you found your boy? That seems easy enough!
Oh that's not all. You forgot about time dilation, didn't you?
What is happening to my memory? Maybe its Mrs. Hudson's tea!
Ok. What about time dilation?
Well, orbiting GPS satellites are affected by time dilation...
What is GPS? What is a satellite?


GPS is short for Global Positioning System, Mr. Holmes.
Dad, dad let me tell him, let me!
Go ahead son!
Mr. Holmes, GPS is a space-based system that provides the location and time information in all weather conditions, anywhere on or near the Earth.
Okay. But, what do you mean when you say 'space based'? And didn't you just say that the famous physicist's time dilation theory affected your GPS?
'Space Based' implies the use of satellites, Mr. Holmes. A satellite is an artificial object which has been intentionally placed into orbit around the Earth. They help us in communication, navigation, observation, research and much more. And before you ask, yes – humans have cracked the space travel mystery. That is how the satellites are placed into orbit around the Earth.
About time dilation effecting GPS, the satellites' speed is slow in comparison to the speed of light. So, the on board clocks would quickly become unsynchronized with the 'stationary' ground based clocks due to time dilation, rendering the GPS useless. But I designed an offset for the on board satellite clocks, which factor in time dilation. It was a tweak of just about 7 microseconds per day. But without it, I would be off track by over 2 kilometers per day!
If you hadn't implemented the tweak, goodness knows when we would have found Dinesh! Not that he seems to be in any hurry to be found!
Indeed! Neither was I, Mrs. Kumar, neither was I.
You're free to stay as long as you want though, Mr. and Mrs. Kumar. I would love to discuss more of science and technology with you. And I'm sure my humble dwelling is any day better that Atlantis!

To be continued ...

# ASK US WHY ?

by **Sasikanth C**

## Why is it easy to balance a moving bicycle, but tough to balance a stationary one?

- Danielle Rodriguez

Have you ever tried riding a bike after locking its handle? Try doing that!

Any object, to be stable when standing upright, needs a base of support. As long as the center of gravity[G] of the object is above this base, it doesn't topple.

The point to note is that any base of support needs three contact points with the ground to be good. However, a bicycle has only two. So, it cannot remain upright when it is stationary. But when you are riding one, you move the steering or handle such that it helps balance all forces (gravitational while leaning, centrifugal while taking a turn, etc.) and stay upright.

We can apply this principle even to balance a stationary bicycle. But lock the handle, and you will not be able to balance a bicycle – stationary or moving – at all! ■

## Does petroleum evaporate like other liquids and come down as rain?

- Mukund Rao

While it is true that petroleum evaporates, note that petrol is not one chemical. It is a mixture of many chemicals like benzene, toluene and xylene. Unlike water molecules, these react with other atmospheric compounds when they are exposed.

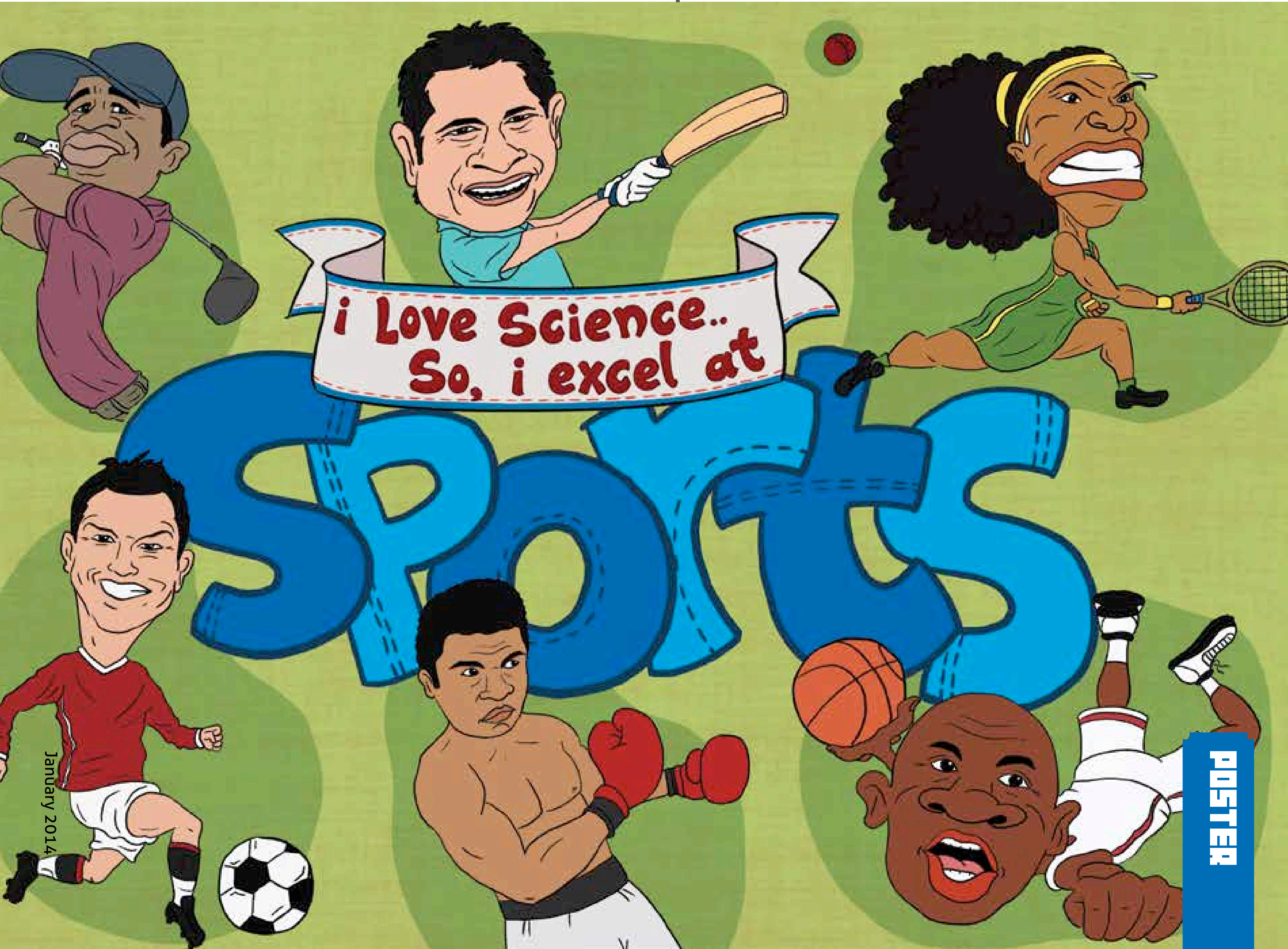
In short, the vaporization process of petroleum is different from that of water - the chemical constituents of petrol volatilize and become gasses, while reacting with other compounds in the atmosphere.

Hence, the chance of a pertrol rain is nil. ■

*Quartz with Petroleum Inclusions. From Balochistan, Pakistan.*

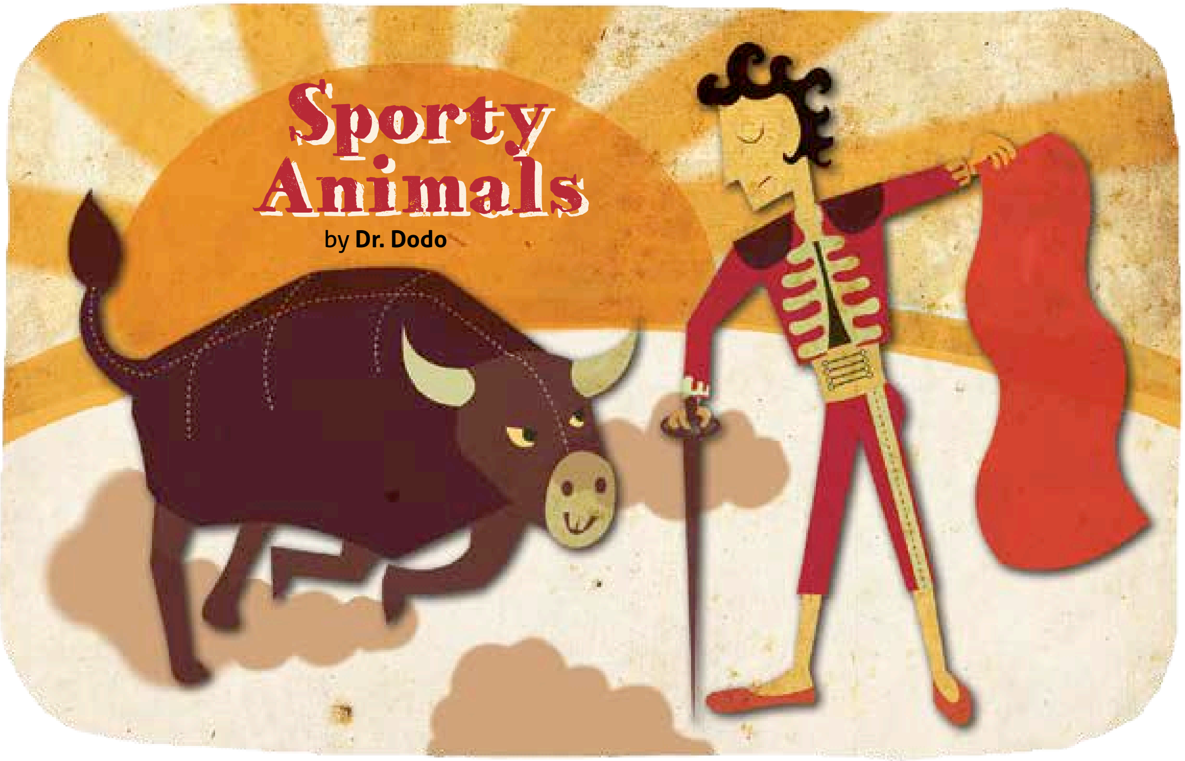
*Image Source: Wikimedia Commons*

Have a burning question? Email us at *brainwave@ack-media.com* with 'Ask Us Why' as the subject. Two best questions get published and win a cool Amar Chitra Katha comic!


i Love Science..
So, i excel at
Sports

# Sporty Animals

by **Dr. Dodo**



Artwork: Saudamini Tambay

## BULL FIGHTING

**THE GAME:** To put it simply, bull fighting is the sport of fighting a bull in an outdoor arena, in front of a hoard of spectators. Bull fighting is a traditional spectacle of Spain, Portugal, Southern France and a few other countries. The person who fights the bull is called the Matador. The matador succeeds when the bull dies.

Of course, Brainwave does not endorse bull fighting in any way. In fact, it should be pointed out that bull fighting is criticized by animal right activits across the world. They refer to it as a cruel or barbaric blood sport.

**THE SCI-TWIST:** There is some science behind many aspects of this sport:

When testing the bulls, men on horseback enter the arena and not matadors with capes. This is because bulls have a good memory power. If they face the matador in training, the real fight can be quite dangerous for the matador. This is also why bulls fight only once in their life.

Bulls are colour blind. They do not respond to the colour of the cape, but the movement of it. ■

## POLO

**THE GAME:** Polo is a team sport where players score by driving a small white plastic or wooden ball into the opposing team's net with the help of a long-handled mallet. Each team consists of four riders and can be a mix of both men and women.

**THE SCI-TWIST:** Science has now barged right ahead and given Polo the option to clone their ace ponies!

Outstanding polo horses were hard to find and horribly expensive. In order to avoid this, technology produced the world's first cloned polo pony in 2010! The technique has now caught fire in Argentina, the global capital of professional polo. It is said that the clones look and act like their 'parents'.

Polo's various governing bodies have approved clones for competition. No clones have yet been tested as they are still below the age of 5. Even then, there is a great demand for these. A 3-month old clone of a really famous polo horse fetched a whooping $800,000 in auction! This also makes it the most expensive sale in polo history so far. ■

## GREYHOUND RACING

**THE GAME:** This sport is an organized competitive event in which greyhound dogs are made to race around a track with the help of a lure. They chase an artificial hare till the first hound crosses the finish line. Needless to say, there is great concern regarding the moral aspects of this sport around the world - gambling and greyhound dog welfare.

**THE SCI-TWIST:** Technology has now taken over the greyhound racing arena. A software called Greyhound Science has been developed. This software claims to predict the outcome of the race in a more scientific and systematic manner. ■

## RODEO

**THE GAME:** This is a competitive sport which arose out of the working practices of cattle herding. In this sport, cowboys show off their skills by riding horses and bulls, or by catching animals with ropes.

**THE SCI-TWIST:** It has been know that Rodeo is a sport that took birth as an outcome of the age-old human versus livestock competition. It tests the speed and skill of the athletes.

Researchers are now conducting tests at different levels to understand this sport. They began by testing rodeo competitors. The players were put through a round of tests to check their personality characteristics, sensation seeking nature and competitive anxiety. The results revealed that the characteristics of these players are comparable to athletes in more traditional sports.

Taking a scientific approach to the assessment of this sport and athletes may ultimately enhance athletic potential, minimize scope for injury and possibly provide information to coaches for the appropriate development and medical care of the athletes. ■

by **Joanne Carlo**

## Positive-therapy

*Discover a new way to stay positive and stay healthy!*

*Image Source: Wikimedia commons*

It all began back in 460 BC, when Hippocrates advocated massage to treat his patients. The first practitioner of physiotherapy, this ancient Greek physician is one of the most outstanding persons in the history of medicine!

Backed by medical science, physiotherapy is a healthcare profession that rehabilitates and rejuvinates people with movement disorders by using natural methods such as exercise and motivation. Sports is one of its many specialties wherein treatment, rehabilitation, prevention and education of individual athletes are taken care off.

When the fitness standards of Indian cricketers needed to be improved drastically after the initiation of the Indian Premier League, team Rajasthan Royals recruited a regular physiotherapist.

Physiotherapy encourages positivity. It is said to be one of the reasons why players like Sachin Tendulkar and Rahul Dravid have extended careers. It helps block out distractions, maintain a healthy environment and most importantly, enjoy every game.

## The Perfect Match

*Are sports drinks good, bad or yummy? Read on to know more!*

Athletes train for hours and hours regularly. They sweat, and expend energy faster than you and I do! Enter sports drinks – beverages with a purpose to help athletes replace their body water and energy.

Does it mean that these are perfect for superior athletic fitness? Let's analyse! Sports drinks contain special ingredients that enchance an athlete's performance. They contain electrolytes that control osmosis in the body and help maintain the acid-base balance required for normal cellular activities.

There are three types of sports drinks - isotonic, hypertonic and hypotonic.

Ideal for those who compete in sporting events for longer than 90 minutes, sports drinks can otherwise prove quite disadvantageous as excessive salt supplementation during exercise may lead to gastrointestinal problems and salt-induced cramps.

But, unlike many advertising promotions, not all sportsmen are hooked on to these hi-tech supplements. There are those who prefer natural foods and methods. Research shows that chocolate milk beats sports drinks for post-exercise muscle recovery. Isn't that news yummy?

### Did you know?

A National Football League lineman can shed up to four kilograms of water weight during a game. Using Chihuahuas as a standard of measure, that comes to 1.5 full-grown dogs!

# Super Sportsmen - Gifts of Science

by **Bhoomi**

*Some athletes train for hours and hours, while some are just talented. Discover the science behind their god-given gifts!*

## Eero Mäntyranta

You'd think that sportsmen of today are just like you and me, plus a few thousand hours of training, of course. But that's not always the case.

Eero Mäntyranta, a competitive cross-country skier won a total of seven medals in the 1960, 1964 and 1968 Winter Olympic Games - three golds, two silvers, and two bronzes. Whoa! How did he win so many medals?

In cross-country skiing, athletes propel themselves over distances of ten and twenty miles - a physical challenge that places intense demands on the ability of their red blood cells to deliver oxygen to their muscles.

Mäntyranta apparently carries a rare genetic mutation. His bone marrow produces 65 per cent more red blood cells than any normal adult male. This unique physiology not only assisted Mäntyranta in winning so many medals but also helped him create a record never equaled in Olympics, before or since! ■

*Men' s high jump during the super track and field meet at Todoroki stadium on September 23, 2009 in Kanagawa, Japan*

## Donald Thomas

Donald Thomas began his sports career with basketball. Moving on to high jump, Thomas, on the seventh high jump of his life, cleared 7' 3.25" – a world class height, almost. And just after eight months of rigorous training, Thomas won the world championship.

How? Well, Thomas was incredibly gifted. He, with his unusually long legs and strikingly long Achilles tendon[G] could project himself high into the air, just like a kangaroo! His Achilles tendon was 26 cm in length, as opposed to the normal length of 15 cm! ■

## Did you know?

Comic actor Jack Black, who lent his voice to Kung-fu Panda, is the son of rocket scientists! His mother worked on the Hubble telescope, and his father worked on 'some stuff that he can't tell us about'.

# Mr. Dependable, Rahul Dravid - 1

by **Team Brainwave**

**BW: Which discovery in the history of mankind do you think changed the way we live?**

**Dravid:** Electricity. It has changed how and where we are able to live and been the base for so many other inventions and developments, both big and small.

**BW: Do you think that in today's world of competition, learning and success go hand in hand? How can students overcome pressure and succeed, while doing what they love?**

**Dravid:** There is no one formula for success or learning. All of us are a mix of different inherent and learnt interests and aptitudes. While competition for certain opportunities is a reality, you face no competition when it comes to being yourself. I strongly believe that success need not be defined as being number one or the topmost at anything specific, it is about working to be the best possible version of yourself.

**BW: Science is in everything we do - music, dance, movie making, cooking, sports, etc. How much of a necessity would you say it is to know or understand science, to excel at these?**

**Dravid:** Awareness of science is a basic life skill. Even if one doesn't have deep knowledge of science, the basic awareness is important to lead a productive and effective life. In my own experience, while playing cricket I had to learn a lot about my body and mind, the psychology of learning and improving, the mechanics of batting and bowling, and lots of other similar things. While I didn't necessarily understand the intricate science behind each of them, I had to learn the applied aspects of science through reading and practice.

**Why would you say it is important to learn science?**

**Dravid:** It is important to be well rounded in your awareness and build a strong base of knowledge when you are young. You never know when this might become useful or important in your life. For example, I would have never guessed how important some of the concepts I learnt in physics or biology class at school would become to my understanding of my sport.

**BW: Some believe that science is a field only for men. Your comments, please?**

**Dravid:** I certainly do not subscribe to that view. Many of the smartest researchers, scientists and practitioners I know are women. Science is for everyone and it is important that we ensure that opportunities to learn and love science are provided to all regardless of gender or background.

**BW: Is science only for students in urban areas? Do you think Science communication needs to be done at grass root and rural level?**

**Dravid:** Like I said, science is for everyone. Anyone can fall in love with it and it is useful throughout one’s life. Science communication that is inclusive will be to everyone’s advantage.

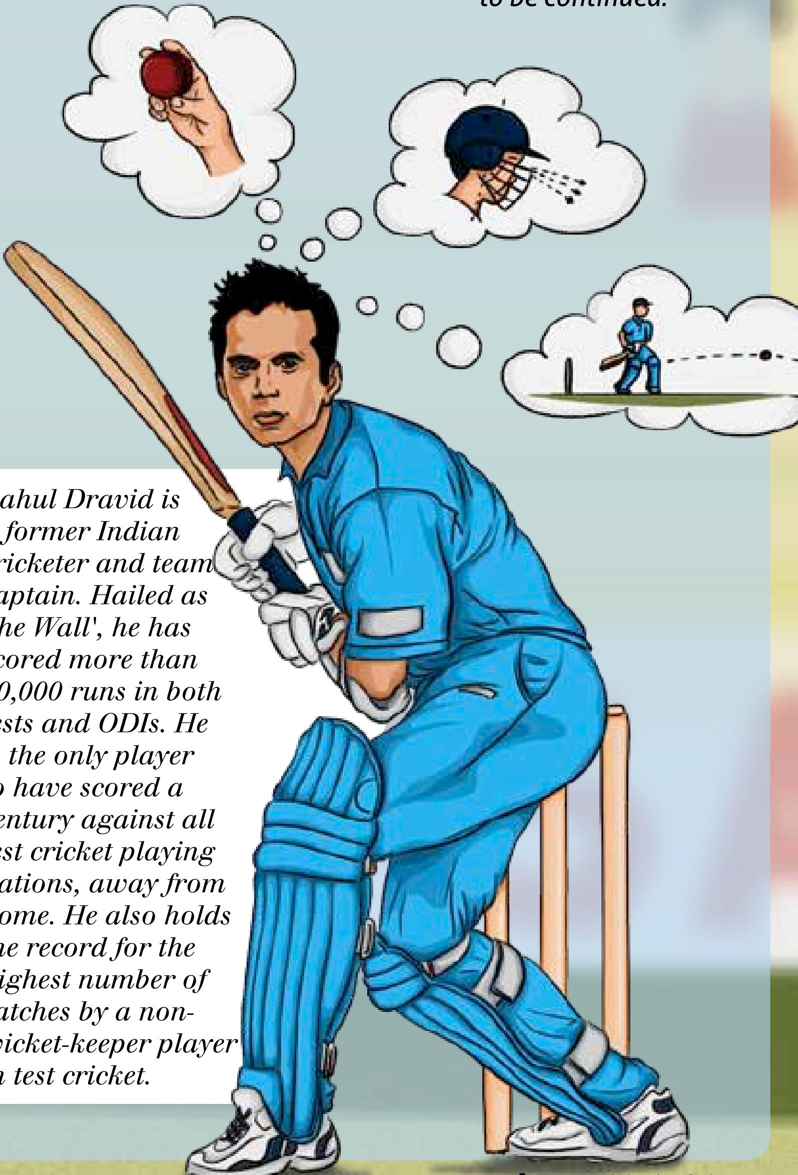
### BW: Keeping the scene from the movie ‘Swades’ in mind (in which Mohan tries to explain his work at NASA to his villagers) - how would you explain your work to the common man?

**Dravid:** While I haven’t watched that movie, I imagine it would be a lot easier to explain to the common man what a cricketer does when compared to a NASA scientist. I would describe my job as being able to score runs for whatever team I played for, and to contribute as best as I could towards the team’s victory in all circumstances.

### BW: Looking down the memory lane, what incident(s) changed your outlook to life?

**Dravid:** The support I got from my school principal and teachers made a big difference to me early on. They encouraged me to pursue my dreams and express my talent. Their support gave me a lot of confidence as it meant that there were others who believed in me and were willing to be part of my journey. As they say, "If you want to travel fast, go alone. If you want to travel far, go together." This was an important lesson I picked up from this experience.

*- to be continued.*



*Rahul Dravid is a former Indian cricketer and team captain. Hailed as 'the Wall', he has scored more than 10,000 runs in both tests and ODIs. He is the only player to have scored a century against all test cricket playing nations, away from home. He also holds the record for the highest number of catches by a non-wicket-keeper player in test cricket.*

Artwork: Jeenal Patel

# Parallel Universe

**Aniket Allakky** *shares a story about a parallel universe where humans are not the smartest, most privileged species.*

One day, on my way to school, a mysterious door appeared in front of me. I thought it was a prank by my friends and entered the door. Soon, I was in a parallel universe. Everything there was completely topsy-turvy compared to our world.

It was the peak of winter and it was snowing heavily. Mr. Snowman's children ran out of their house to build a hu-man. Mrs. Leaf was returning from the market with a bag full of humans organs.

I could hear a faint sob from the next house. It was Mrs. Onion, crying due to the fumes from chopped hum-genes. Mr. Rover was trying to catch his new human pet that broke loose. The loose human pet ran on to the road and made the horse-man lose control of his human-cart. The cart slammed into Mr. Greeny, the human DNA gardner.

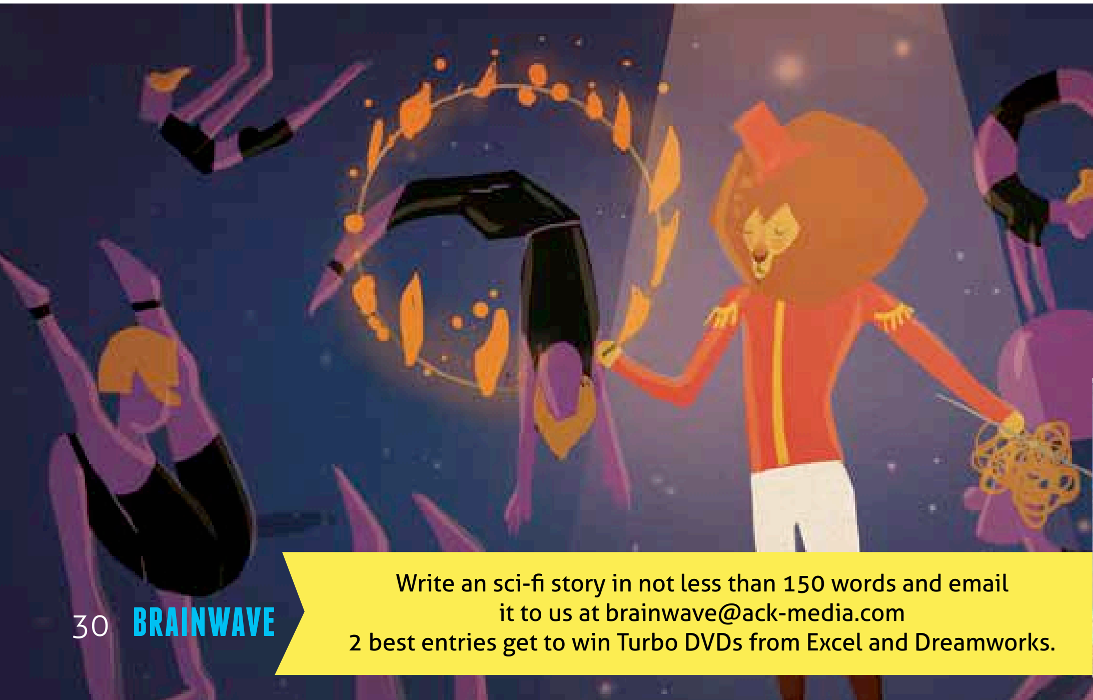
Boy, everything was so weird! The door behind me, probably the portal to a parallel universe, had disappeared. I moved on to explore the new world, and went to a supermarket. I was shocked! The clothes department had a huge sale of designer bags and jackets made of Human Skin.

I couldn't stand what I was seeing and ran aimlessly, to get back to our world. I ran a few blocks and reached something called 'The Great Earth Circus'. Not expecting any worse than what I had already experienced, I entered it. Not to my surprise, I saw a Lion ring master named Mr. Pride wearing a shiny blazer and holding a whip, commanding humans to balance themselves on a giant ball and jump through rings of fire!

I was at my wits end, totally baffled. I closed my eyes and began running. While running frantically, I banged into something. I opened my eyes, and saw the misterious door again! I ran straight through it, to never look back.

I still wonder if the experience was real or if it was a dream. ■

Artwork: Parvati Pillai



Write an sci-fi story in not less than 150 words and email
it to us at brainwave@ack-media.com
2 best entries get to win Turbo DVDs from Excel and Dreamworks.

# SOLUTIONS AND WINNERS

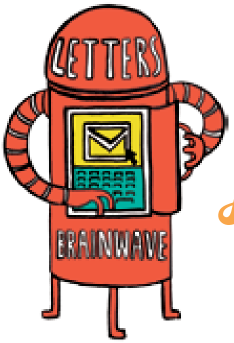
Winners of various activities in the November 2013 issue are:
Treasure Hunt: Saravanan & Daiwik Shah
Toy Box: Aman Sharma
Ask Us Why: Vidhu Raturi
Fan Fiction: Roshan Warrier
Magic Science: Bhavya Mehta
Planet Ninjas: Arka Karmakar
Sci-Q Time: Vaman Neurekar
DIY: Abhyudaya Agarwal

Arka Karmakar get nominated for the BW Student Board. For more details, visit *www.bwmag.in/student-board*

The BW Smartenstein title, certificate and mystery gift for November go to Bhavya Mehta. For more details, visit - *www.bwmag.in/category/bw-smartenstein*

Winners of the Rangeela Contest gift hamper are: Thanothii Ganesh, Yasasweni Balaji and Vibhusha Ashok

December 2013 winners will be declared in the February 2014 issue.



# Letters from Readers

Brainwave is a really nice magazine. However, due to some unknown reason I did not get the January 2013 and September 2013 issues. Would be grateful if you could send them too.
*Chitteshwari Satish – via email*

Dear Satish,
Please email me your subscription number. It will help us pull out your address and dispatch the copies.
*SK, Editor*

I am writing from Mexico just to let you know that I recently discovered your magazine (digital version) and I loved the the three issues I picked up. I have a 7-year old son and even though he isn't familiar with English language, I look forward to read it along with him, make the experiments and discover the rest of the content. Thanks to the whole team for making Brainwave possible! Regards.
*Enzo Hdz L – Via Facebook*

Dear Enzo Hdz,
Great to hear from you. A child's learning starts at home. Parents play a very crucial role in this - more than teachers and schools. Great to know that you realize it and help your child. Am sure that you would be delighted to know that at the moment I am in Santiago, Chile and working on translating our products into Spanish.
- *SK, Editor*

I have been subscribing to your magazine, Brainwave since four months. I really do love your issues a lot as they have lots of science activities. Once Brainwave magazine arrives, I snatch it from my mother's hand and start reading it at once. Brainwave is the best magazine I have ever read. Three cheers to the Brainwave team.
*Nivedita Anand – Via post*

Dear Nivedita,
I love hearing from readers like you. It would be great to know your thoughts on the specific articles you like and those you do not. You can write to me directly at
sasikanth.c@ack-media.com
*SK, Editor*

# Sports Funnies

by **Joanne Carlo**

*Are you bored? Come spend some time reading a few funny facts about sports!*

## Monkey-guard

*Who Guarded the Commonwealth Games 2010? Take a wild, wild guess!*

We are sure that your guess isn't even close. In 2010, apart from sniper units and soldiers, the Delhi commonwealth games authorities deployed 38 trained Langur monkeys. Gulp!

Why? Well ... to scare off other wild life, including monkeys, dogs and snakes! Langur monkeys are noted for their intelligence and aggression. They are highly effective in deterring other animals from taking up residence.

So, who's up for the next Commonwealth Games? It's in Glasgow, Scotland. ■

## Horsing Around

*Gurgle-gurgle-gurgle, is that a horse running underwater? Am I dreaming?*

You've heard of scuba diving. You might even have heard of underwater yoga. But, have you heard of underwater treadmills, for horses? Yes, you heard right!

A combination of treadmill, whirlpool and swimming pool, the underwater treadmill is used for injury rehabilitation, strengthening, conditioning and training. Why underwater treadmills? Well ... the reasoning is apparently quite simple. These treadmills promise reduced injury recurrence as compared to good old regular treadmills.

The way this works is interesting. The horse's body weight is reduced when under water. So, there is less strain on the supporting structures of their legs - bones, joints, tendons, and ligaments. Also, studies show that walking underwater requires less muscular movement. Hence, it provides therapy for the cardiovascular and muscular systems, while exercising limbs.

Many winning race and performance horses are said to have benefited from this. ■

## Did you know?

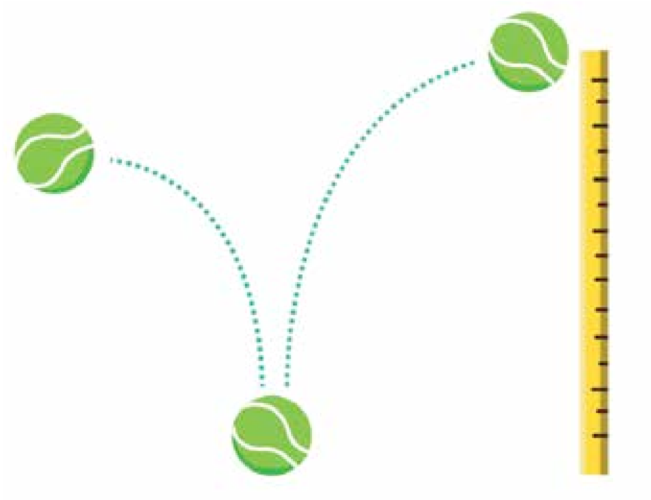
**Astronaut Alan Shepard played golf on the Moon after he smuggled golf balls and clubs on to the NASA Apollo 14 mission to the Moon in 1971.**

# The Shivering Ball

by **Pushkar Samant**

*Find out the effects of varying temperatures on a tennis ball.*

We all know that a tennis ball bounces if we drop it from a certain height. But can we control its bounce by doing anything? Can the green fur ball be stopped from bouncing? Here is something to try.



Take a tennis ball. Bounce it for some time to note down the average height of its bounce. You can measure the height of the bounce with the measuring tape. Now, leave the ball in the freezer for at least three hours. Take it out and drop it from a certain height. Measure the bounce again.

Artwork: Saudamini Tambay

What do you observe? What happened to the bounce? Also, guess the sport in which the tool that is used to play is kept in a freezer for 10-12 days before the game starts? ■

Research and email your answers to us at brainwave@ack-media.com
The winner gets latest ACK and Tinkle comics!

# BW STUDENT BOARD

The Student Board evaluation process is almost complete. The winners shall be revealed soon! Be on a lookout for their names. For the next six months, these members will work with our editorial team and make a difference to the magazine.

In addition to this, their work will be published in the magazine and they will get to lay their hands on all BW products before anyone else - for free!

At the end of their tenure, they will win certificates and an honorarium of Rs. 1250 each.

www.bwmag.in/student-board

**Join us on our fun-do video channel as *Mr. X* performs some amazing experiments and *X-plains* the science behind them.**

**Mr. X will perform and publish your experiments too! If published, you will win a surprise gift. Just email your experiments in detail to brainwave@ack-media.com**

You Tube

*www.youtube.com/Brainwavemag*

*Artwork: Abhijeet Kini*

# NEW BEGINNINGS

*As another exciting New Year arrives, we take a look at some of the most promising achievements that India has made in the field of science.*

by **Priyanka Talreja**

## This Month, That Year - The Guided Missiles

Defense is an important function of the government. And to fulfill that, India successfully launched the Integrated Guided Missile Development Program, a program for the research and development of a comprehensive range of missiles.

It was on the 8th of January, 2008 that the completion of the IGMDP was announced. The last major missile developed under this program was the Agni 3, with a range of 3,500 to 5,000 km. The Agni 3 was inducted into the Indian army in June 2011. ■

## Blast From the Past - Cataract Surgeries

Did you know that cataract surgeries were first performed in India in the 6th century BCE? Back then, India was far ahead of the times.

These surgeries were performed with a special tool called the Jabamukhi Salaka, which was nothing but a curved needle used to loosen the lens and push the cataract[G] out of the field of vision. The eye would later be soaked with warm butter and bandaged.

These surgeries were so successful that Greek philosophers and scientists traveled to India to learn the procedure. India also introduced China to the removal of cataract by surgery. ■

## Peek into the Future - The Copenhagen Wheel

Indians are contributing a lot to technology. Myshkin Ingawale, a PhD scholar from India has invented the revolutionary Copenhagen Wheel. In simple terms, this wheel is a device to be attached to a bicycle. Once that is done, it transforms ordinary bicycles into hybrid e-bikes that also function as mobile sensing units.

The Copenhagen Wheel allows cyclists to capture the energy dissipated while cycling and braking, and save it for when they need a boost. It also maps pollution levels, traffic congestion, and road conditions in real-time! ■

Image Source: Wikimedia Commons

# TECH TURN IN 2014

by **Priyanka Talreja**

*The New Year is buzzing! Lots of awesomeness is lined up for us. Let's take a look, shall we?*

*Image Source: Wikimedia Commons*

## Popular Events:

**The International CES**
***January 7–10, 2014; Las Vegas***

CES or the Consumer Electronics Show is a major technology related trade show. Here, over 3,000 exhibitors showcase a wide range of innovative products. This is the most exciting tech exhibition with great concepts and gadgets on display. Last year had an advanced range of categories - 3D, accessories, audio, automotive electronics, embedded technology, lifestyle electronics and wireless devices - to name a few. What does 2014 have in store? We will soon find out!

**IBM Connect 2014**
***January 26 – 30, 2014; Orlando***

At IBM Connect 2014, visitors can gain insights about game-changing technology and strategies in social media, mobile, cloud, smarter workforce, cognitive systems, smarter commerce and business analytics. A lot to learn here about future technologies!

**Mobile world Congress**
***February 24 -27, 2014; Barcelona***

The one technology event everyone must know about is the Mobile World Congress. This event boasts to be the world's largest exhibition for the mobile industry and it features prominent executives representing mobile operators, device manufacturers, technology providers, vendors and content owners from across the world.

In 2013, the theme of the Mobile World Congress was 'The New Mobile Horizon'. It was attended by more than 72,000 participants. Now, that is a lot of people! ■

## Days to Remember:

Here are two great scientists who were born in January:

**January 8**
Stephen Hawking – he is a British theoretical physicist, cosmologist, and author. He is known for his significant scientific work such as the theoretical prediction that black holes emit radiation, often called Hawking radiation.

**January 17**
Benjamin Franklin – he was one of the Founding Fathers of the United States of America. As a scientist, Franklin was a major figure in the American Enlightenment and the history of physics. He is known for his discoveries and theories regarding electricity. His major inventions include the lightning rod, bifocals, the Franklin stove, a carriage odometer, and the glass 'armonica'. ■

# Target Practice

*Why can't we aim accurately with one eye closed?*

by **Pushkar Samant**

After making my pen-bow (p06 Toy Box), I tried aiming at an empty plastic bottle. However, my first attempts with one eye closed weren't successful. I missed constantly.

After missing the target continuously, I tried by keeping both my eyes open. I hit the plastic bottle in the first attempt!

How was that possible?

Surprisingly, when I tried again with one eye closed, I couldn't hit the target. I didn't understand what was wrong with my aim.

Can any of you tell me what's happening in this case? What science am I unable to understand? ■

Research and email your answers to brainwave@ack-media.com
The most enthusiastic response can win you cool gifts worth Rs. 200!

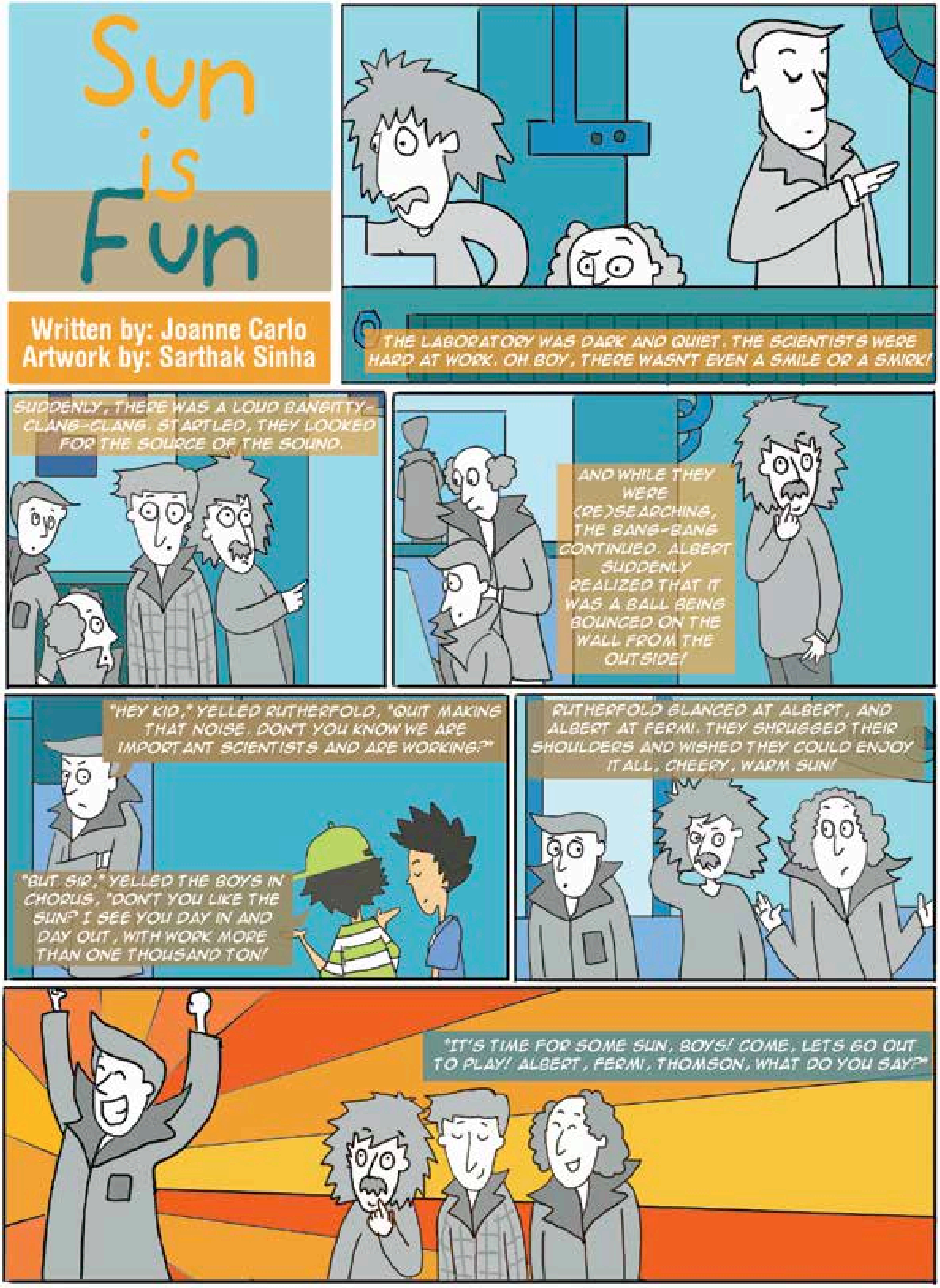
Now, get more bang for your buck!

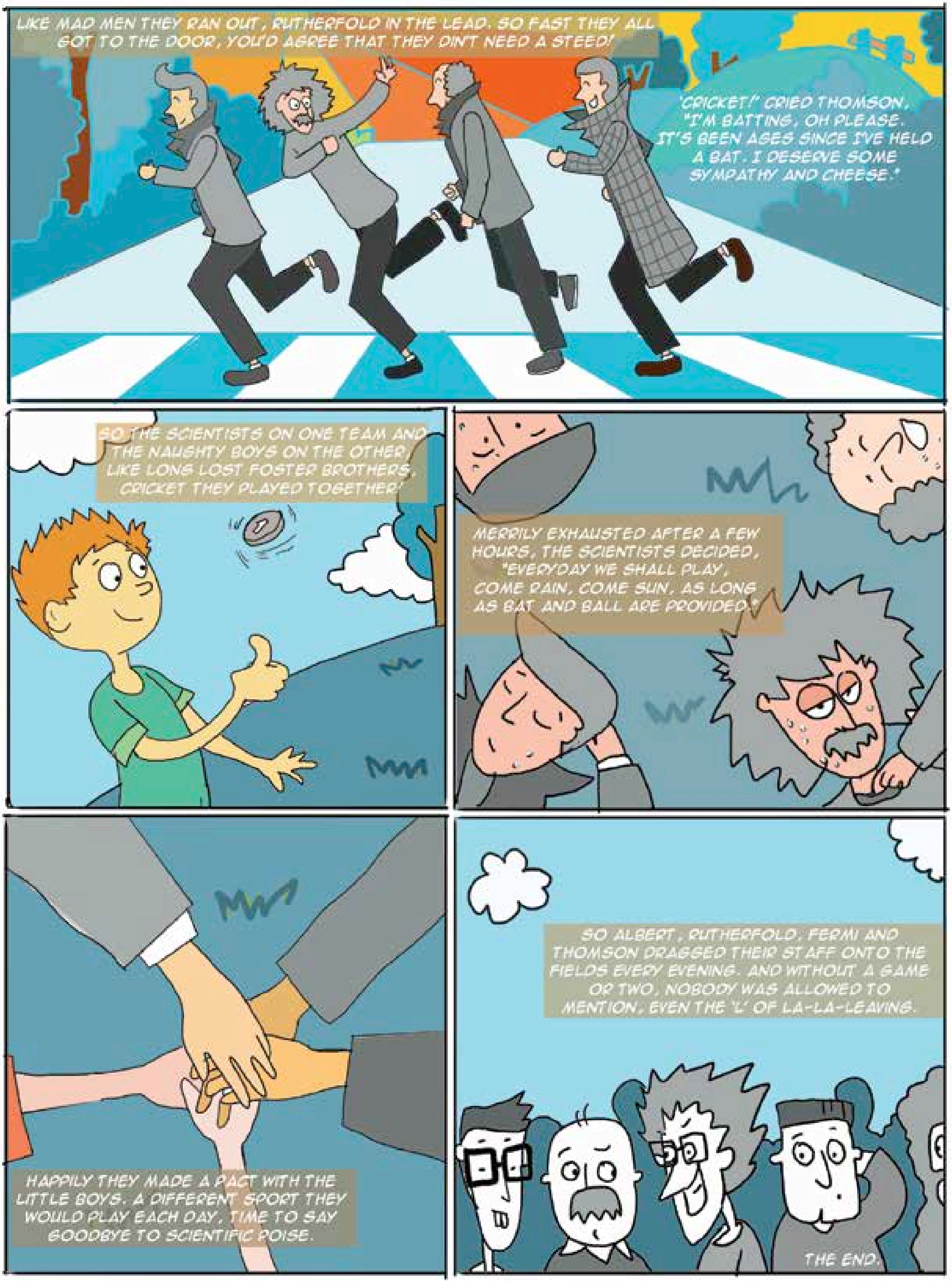
Visit our website for extra content every month - exclusively for our subscribers!

www.bwmag.in/category/web-only-articles

# Sun is Fun

Written by: Joanne Carlo
Artwork by: Sarthak Sinha


THE LABORATORY WAS DARK AND QUIET. THE SCIENTISTS WERE HARD AT WORK. OH BOY, THERE WASN'T EVEN A SMILE OR A SMIRK!
SUDDENLY, THERE WAS A LOUD BANGITTY-CLANG-CLANG. STARTLED, THEY LOOKED FOR THE SOURCE OF THE SOUND.
AND WHILE THEY WERE (RE)SEARCHING, THE BANG-BANG CONTINUED. ALBERT SUDDENLY REALIZED THAT IT WAS A BALL BEING BOUNCED ON THE WALL FROM THE OUTSIDE!
"HEY KID," YELLED RUTHERFOLD, "QUIT MAKING THAT NOISE. DON'T YOU KNOW WE ARE IMPORTANT SCIENTISTS AND ARE WORKING?"
"BUT SIR," YELLED THE BOYS IN CHORUS, "DON'T YOU LIKE THE SUN? I SEE YOU DAY IN AND DAY OUT, WITH WORK MORE THAN ONE THOUSAND TON!
RUTHERFOLD GLANCED AT ALBERT, AND ALBERT AT FERMI. THEY SHRUGGED THEIR SHOULDERS AND WISHED THEY COULD ENJOY IT ALL, CHEERY, WARM SUN!
"IT'S TIME FOR SOME SUN, BOYS! COME, LETS GO OUT TO PLAY! ALBERT, FERMI, THOMSON, WHAT DO YOU SAY?"


LIKE MAD MEN THEY RAN OUT, RUTHERFOLD IN THE LEAD. SO FAST THEY ALL GOT TO THE DOOR, YOU'D AGREE THAT THEY DIN'T NEED A STEED!
'CRICKET!' CRIED THOMSON. "I'M BATTING, OH PLEASE. IT'S BEEN AGES SINCE I'VE HELD A BAT. I DESERVE SOME SYMPATHY AND CHEESE."
SO THE SCIENTISTS ON ONE TEAM AND THE NAUGHTY BOYS ON THE OTHER, LIKE LONG LOST FOSTER BROTHERS, CRICKET THEY PLAYED TOGETHER!
MERRILY EXHAUSTED AFTER A FEW HOURS, THE SCIENTISTS DECIDED, "EVERYDAY WE SHALL PLAY, COME RAIN, COME SUN, AS LONG AS BAT AND BALL ARE PROVIDED."
HAPPILY THEY MADE A PACT WITH THE LITTLE BOYS. A DIFFERENT SPORT THEY WOULD PLAY EACH DAY, TIME TO SAY GOODBYE TO SCIENTIFIC POISE.
SO ALBERT, RUTHERFOLD, FERMI AND THOMSON DRAGGED THEIR STAFF ONTO THE FIELDS EVERY EVENING. AND WITHOUT A GAME OR TWO, NOBODY WAS ALLOWED TO MENTION, EVEN THE 'L' OF LA-LA-LEAVING.
THE END.

# No sports make Jack a dull boy

by **Dr. Dodo**

*Lack of outdoor activity is adversely effecting the current generation. Bhoo meets some kids addicted to video games.*

Artwork: Jeenal Patel

During the Christmas vacations, Bhoo was flying around, enjoying an aerial view of the Earth. In most countries, she saw that no children were playing in open grounds. So, she decided to visit some homes and find out what's happening. She flew into a house in Japan. She saw that the kids was playing combat games on the console.

“Why aren’t you playing outside? It's holiday time!” Bhoo asked, peeping into the screen.

“We enjoy video games more,” San replied, without looking up from the screen.

“But, without enough physical activity, won't you face health issues, physical as well as psychological, in the future?” Bhoo asked in a grim tone.

San and his friends looked at her, “What do you mean?” they asked in unison.

**“For starters, no physical activity turns you obese. The World Health Organization says that more than 40 million children of your age are facing this problem,”** Bhoo explained.

“Is it so?” Hosito asked, bewildered!

“Yes. In addition, if you do not go out to play, you will be unable to build positive competitive spirit within youselves,” Bhoo explained, talking about the psychological effects. “Not experiencing the psychological ups and downs of sports makes you whiny and paranoid about little things in life.”

“This is real bad,” San agreed, as he understood the seriousness. He immediately switched off the console.

“If you don’t want any of these to happen to you, better start going out to play. Remember - all home and no outdoor activity makes Jack a dull boy. Now, let me go meet kids in other countries too,” Bhoo said and flew out of the window. ■

List out more problems we can face if we do not take part in outdoor activities. Research and email your solutions to Bhoo at *brainwave@ack-media.com* to get a chance to be nominated for our Student Board as well as win a surprise gift!

# Game Tech-tics

*Today, sports are a lot more dependent on technology than ever before.* by **Pushkar Samant**

## Wear to win

The clothes athletes wear are contributing to close finishes in many sports.

For instance, in the sport of swimming, manufacturers are enhancing materials and fits, as well as are collaborating closely with scientists who are experts at fluid dynamics. Swimming suits today are computer-modeled and tested in wind tunnels! The new designs help in reducing water resistance and lead to a winning end. ■

## Change in Court

Tennis courts have always been categorized as grass, clay, hard and carpet courts, each with their own play characteristics. Tournaments that use specific courts to play at a particular speed and bounce have been created.

Hard courts offer the most variety. Instead of just asphalt or concrete, court surfaces are now built out of decoturf$^{G}$, rebound ace$^{G}$ or plexicushion$^{G}$. These can speed up or slow down the game, depending on how they are put together. These hi-tech modifications of courts have changed the game to a larger extent. ■

## Ice Bath

Just like Michael Schumacher's car needs a complete overhaul after a Formula One race, the body needs to service itself for the next game or match after a physically exerting game. For this, sportsmen prefer an ice bath.

The body services itself with the help of blood vessels that supply oxygen to the tissues and remove waste products such as lactic acid. Too much lactic acid can cause the muscles to function poorly.

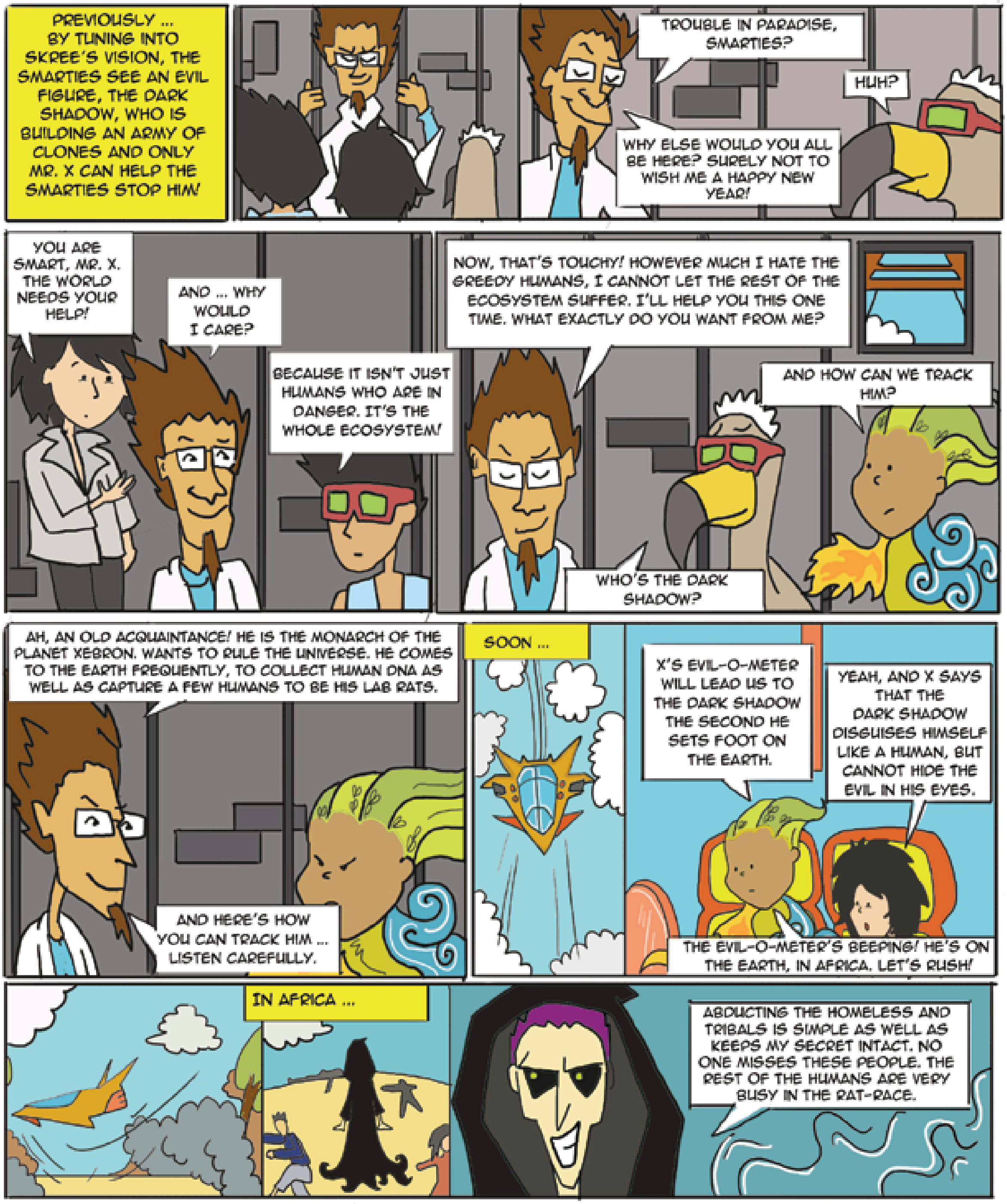
The icy cold water in an ice bath causes blood vessels to tighten up, and drains the blood out of the legs. A sportsman sits in a tub filled with ice cold water. After 10 minutes, his legs feel numb. Coming out of the bath fills up the legs with 'new' blood that invigorates the muscles with oxygen and helps cells function better. ■

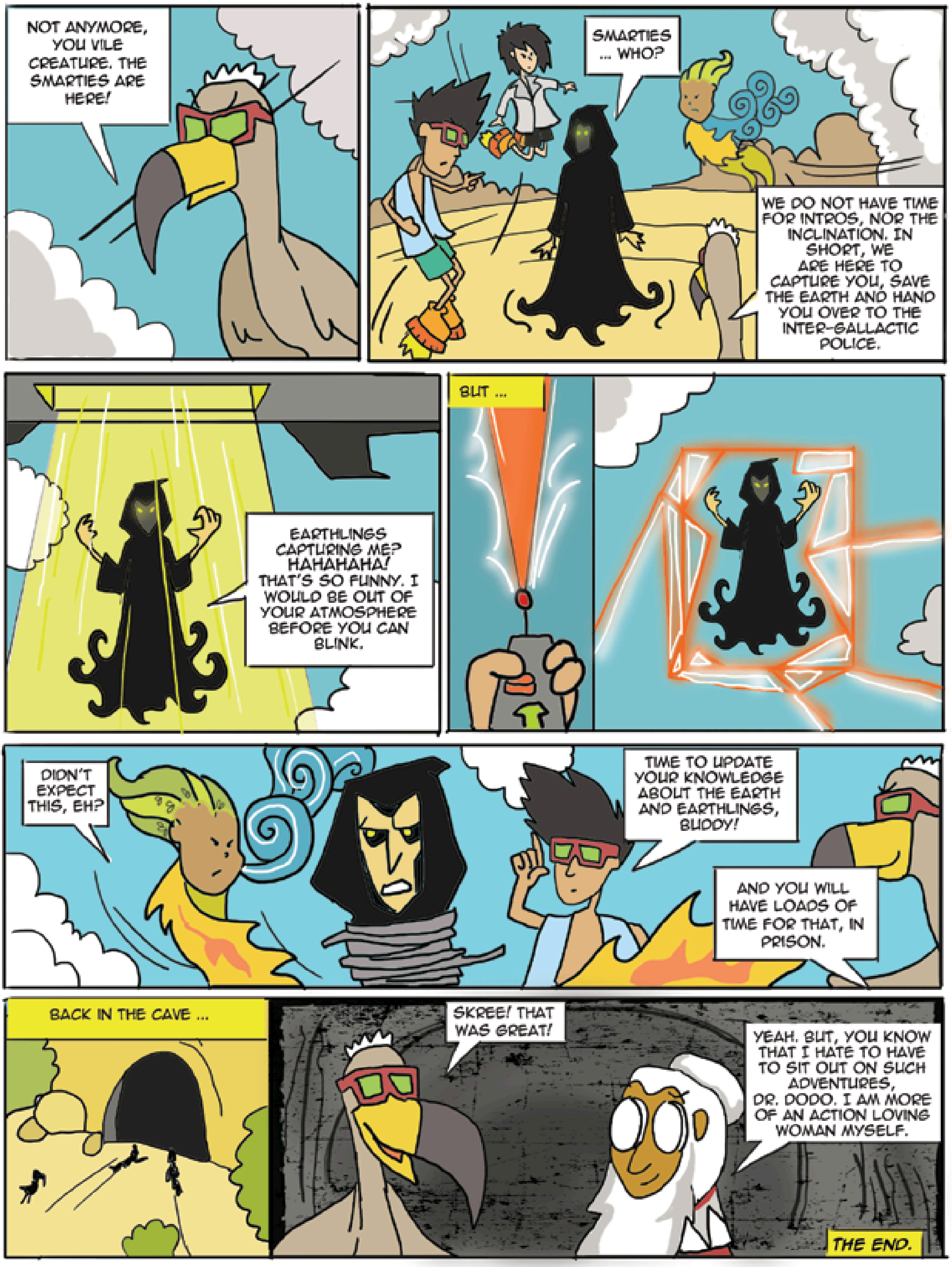
Images Source: Wikimedia commons

# THE SMARTIES

## THE DARK SPELL 3

STORY: SASIKANTH C ART AND LETTERING: SARTHAK SINHA

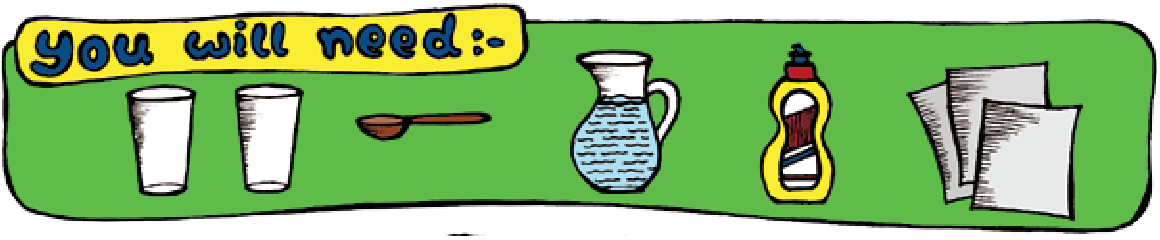

PREVIOUSLY ... BY TUNING INTO SKREE'S VISION, THE SMARTIES SEE AN EVIL FIGURE, THE DARK SHADOW, WHO IS BUILDING AN ARMY OF CLONES AND ONLY MR. X CAN HELP THE SMARTIES STOP HIM!
TROUBLE IN PARADISE, SMARTIES?
HUH?
WHY ELSE WOULD YOU ALL BE HERE? SURELY NOT TO WISH ME A HAPPY NEW YEAR!
YOU ARE SMART, MR. X. THE WORLD NEEDS YOUR HELP!
AND ... WHY WOULD I CARE?
BECAUSE IT ISN'T JUST HUMANS WHO ARE IN DANGER. IT'S THE WHOLE ECOSYSTEM!
NOW, THAT'S TOUCHY! HOWEVER MUCH I HATE THE GREEDY HUMANS, I CANNOT LET THE REST OF THE ECOSYSTEM SUFFER. I'LL HELP YOU THIS ONE TIME. WHAT EXACTLY DO YOU WANT FROM ME?
AND HOW CAN WE TRACK HIM?
WHO'S THE DARK SHADOW?
AH, AN OLD ACQUAINTANCE! HE IS THE MONARCH OF THE PLANET XEBRON. WANTS TO RULE THE UNIVERSE. HE COMES TO THE EARTH FREQUENTLY, TO COLLECT HUMAN DNA AS WELL AS CAPTURE A FEW HUMANS TO BE HIS LAB RATS.
AND HERE'S HOW YOU CAN TRACK HIM ... LISTEN CAREFULLY.
SOON ...
X'S EVIL-O-METER WILL LEAD US TO THE DARK SHADOW THE SECOND HE SETS FOOT ON THE EARTH.
YEAH, AND X SAYS THAT THE DARK SHADOW DISGUISES HIMSELF LIKE A HUMAN, BUT CANNOT HIDE THE EVIL IN HIS EYES.
THE EVIL-O-METER'S BEEPING! HE'S ON THE EARTH, IN AFRICA. LET'S RUSH!
IN AFRICA ...
ABDUCTING THE HOMELESS AND TRIBALS IS SIMPLE AS WELL AS KEEPS MY SECRET INTACT. NO ONE MISSES THESE PEOPLE. THE REST OF THE HUMANS ARE VERY BUSY IN THE RAT-RACE.


NOT ANYMORE, YOU VILE CREATURE. THE SMARTIES ARE HERE!
SMARTIES ... WHO?
WE DO NOT HAVE TIME FOR INTROS, NOR THE INCLINATION. IN SHORT, WE ARE HERE TO CAPTURE YOU, SAVE THE EARTH AND HAND YOU OVER TO THE INTER-GALLACTIC POLICE.
EARTHLINGS CAPTURING ME? HAHAHAHA! THAT'S SO FUNNY. I WOULD BE OUT OF YOUR ATMOSPHERE BEFORE YOU CAN BLINK.
BUT ...
DIDN'T EXPECT THIS, EH?
TIME TO UPDATE YOUR KNOWLEDGE ABOUT THE EARTH AND EARTHLINGS, BUDDY!
AND YOU WILL HAVE LOADS OF TIME FOR THAT, IN PRISON.
BACK IN THE CAVE ...
SKREE! THAT WAS GREAT!
YEAH. BUT, YOU KNOW THAT I HATE TO HAVE TO SIT OUT ON SUCH ADVENTURES, DR. DODO. I AM MORE OF AN ACTION LOVING WOMAN MYSELF.
THE END.

# Sink or Swim?

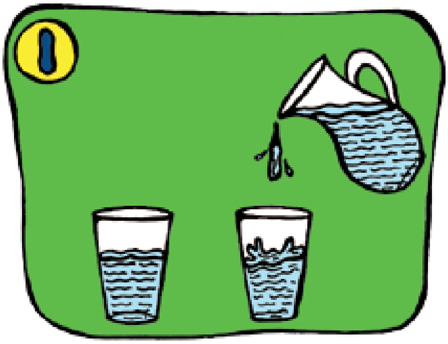
*Why is it that we can swim faster under water than on the surface?*

by **Pushkar Samant**



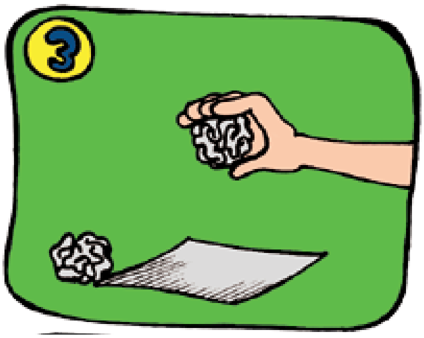
- Two glasses
- A spoon
- Water
- Dish Soap
- Pieces of paper

## Method:



Fill both the glasses with water up to the same level.

To one of the glasses, add 2 spoons of dish soap and gently stir the solution.



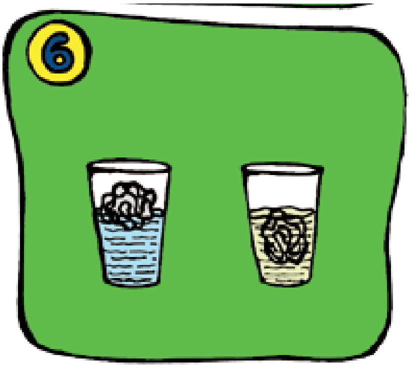
Make two identical balls of paper that can fit into your glasses of water.

Gently drop one paper ball into the plain water.

Artwork: Jeenal Patel

Watch the video at: *www.youtube.com/watch?v=dummy*

Drop another paper ball into the soapy water solution.



You will observe that the paper balls behave differently in the two fluids. One paper ball begins to sink quickly, while the other floats on the surface.

## How does this happen?

What you are observing is called the surface tension of water. Soap is a surfactant, a compound that lowers the surface tension of a liquid. Soap decreases the surface tension of water by weakening the hydrogen bonds that make water such a special substance.

When swimming on the surface of water, we must overcome that surface tension. You can kick faster under water than you can swim on the surface. Some professional swimmers can kick almost the entire length under water! They come to the surface right before they need to make a turn, turn and go as far as they can under water for the next length too.

Now, here is something for you to research and answer - why do swimmers wear swimming caps? Does a swimming cap affect the speed of a swimmer in any way? ■

Email your answers to *brainwave@ack-media.com*
The best and most original answer wins two cool ACK comic books!

## NOTES

# Treasure Hunt!

You must be aware of the grind by now. The Treasure Hunt leads you to the theme of the next issue. Take your magnifying glass out and become the adventurer. Follow the words or phrases marked in pink in this issue and use them as your clues.

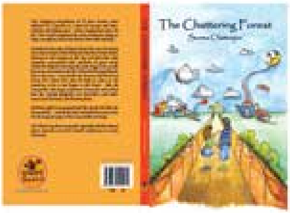
……

Look closer and you will find enough clues to get you cracking. What are you still waiting for? Get started and finish fast, to better your chances of a win!

The top two entries will win two cool books each from Leadstart Publishing. Email your answers to brainwave@ack-media.com with 'Treasure Hunt' as the subject.

LEADSTART
Publishing

**2 WINNERS GET 2 COOL BOOKS EACH, EXCLUSIVE FROM LEADSTART PUBLISHING!**



# Be a Smartenstein!

We run more than ten activities and contests in each issue. They can win you many exciting prizes.

Artwork: Sarthak Sinha

Participate in all the activites of an issue, and you can win a merit certificate, the title 'Smartenstein' and a mystery gift - every month!

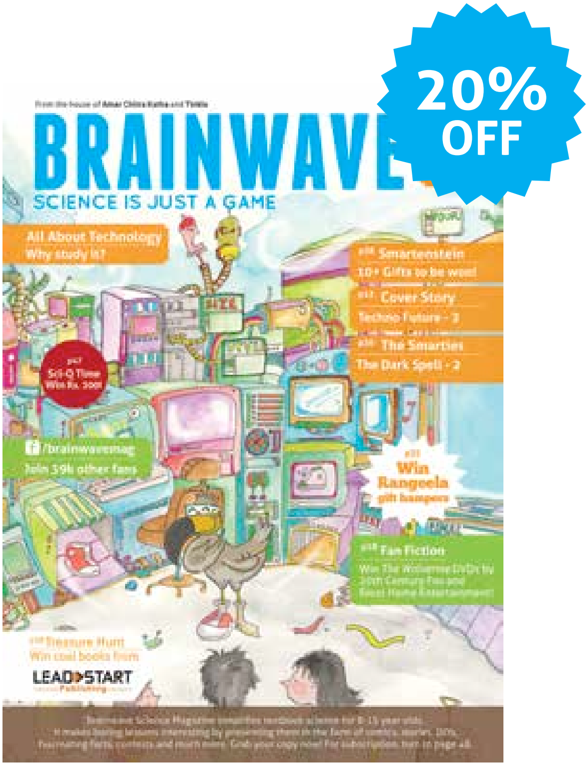
There are more than 10 activities and contests in this issue. Turn to the index on p02, check the features marked with a '✡' out, and participate in them.

What are you waiting for? Settle down with your favourite snack and get started!

www.bwmag.in/category/bw-smartenstein

# SUBSCRIBE NOW!

## Pay only ₹ ~~720~~ 580!
## Get 12 issues of



20%
OFF

**Why pay ₹ 60 every month (that's ₹720 a year) at your news-stand to enjoy Brainwave?**

Now, Brainwave is the perfect balance of science and fun, which will make you call your friends up and say, "Guys, let's play science!"

You get 48+ pages of comics, stories, experiments and contests. There is a Treasure Hunt too! You can win many exciting prizes and even be on our **Student Board**.

## SUBSCRIPTION TYPE

- ☐ **1 year: Brainwave - ₹580**
- ☐ **2 year: Brainwave+Mystery Gift of ₹299 - ₹1150**
- ☐ **1 year: Brainwave+Tinkle magazine - ₹880**

## YOUR DETAILS*

Student's Name: ____________________
Guardian's Name: ____________________
Date of Birth: ______________(DD MM YYYY)
Address: ____________________
____________________
____________________
City: ____________________
State: ____________________
School: ____________________
Class: ____________________
Email (Student): ____________________
Email (Guardian): ____________________
Tel. of Guardian: (R): ____________________
Mobile: ____________________

____________________
Guardian's signature

## PAYMENT OPTIONS

☐ **CREDIT CARD**

Card Type: ☐ Visa ☐ MasterCard
Please Charge ₹_____ to my Credit card
Number below:
☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐
Expiry Date: M M Y Y

____________________
Card member's signature

☐ **CHEQUE/DD**

Enclosed please find cheque/DD no. ☐☐☐☐☐☐
drawn in favour of 'ACK Media Direct Ltd.'
on (bank) ____________________ ,
for the amount ____________________ ,
dated D D / M M / Y Y Y Y .

## ONLINE SUBSCRIPTION

Visit: *www.amarchitrakatha.com*
Email: *brainwave@ack-media.com*

**ACK Media Direct Pvt. Ltd.,** Krishna House, 3rd Floor,
Raghuvanshi Mills Compound, Senapati Bapat Marg,
Lower Parel (West) Mumbai - 400013.

Publisher, at its sole discretion, shall have the right to revise the offer or subscription price.

* All fields are mandatory for the subscription to be activated.

# SCIENCE GLOSSARY

## p11

**Thesis:** A comprehensive research report university students submit to complete their studies and gain an academic degree.

**Motor Skill:** A function, which involves the precise movement of muscles with the intent to perform a specific act. Motor difficulties occur when one lacks the ability to move in the way originally intended. This can have a significant effect on classroom performance and motivation. *Source: educlime.com*

## p15

**Gravity-step:** Here, watch Nadal's footwork as he moves from the left side of the court, back to the center: *www.tennisone.com/club/lessons/jm/nadal/nadalanimation.gif*
He begins by moving his right leg in the opposite direction to where he actually needs to go, right? This shifts the center of gravity of his body to the top, topples him momentarily and hence, lets him move back faster.

## p22

**Center of Gravity:** The point at which all of the weight of an object appears to be concentrated. When an object is suspended so that it can move freely, its center of gravity is always directly below the point of suspension. An object can be balanced on a sharp point placed directly beneath its center of gravity. *Source: howstuffworks.com*

## p27

**Achilles Tendon:** A tendon is a tough band of fibrous connective tissue that usually connects muscle to bone. The Achilles tendon is the thickest and strongest tendon in the human body. It is about 15 centimetres long, and begins near the middle of the calf.

## p35

**Cataract:** A cataract is a clouding of the lens inside the eye, which leads to a decrease in vision. It is the most common cause of blindness and is usually treated with surgery.

## p41

**Decoturf:** A tennis hardcourt comprising layers of acrylic, rubber, silica, and other materials on top of an asphalt or concrete base.

**Rebound Ace:** A cushioned tennis hardcourt composed of polyurethane rubber, fiberglass, and other materials on top of an asphalt or reinforced concrete base.

**Plexicushion:** An acrylic-based hard court tennis surface.

## Sci-Q Time

Finished reading the magazine? Answer this quiz to win a mystery gift worth Rs. 200! Email your answers as soon as possible to brainwave@ack-media.com

1. What is a surfactant?
2. How does too much lactic acid build up affect our muscles?
3. What are the constituents of petroleum?
4. How does a GPS system work? Explain in detail.
5. What is the law of conservation of energy? Give an example.

**To take part in some cool science initiatives, visit** *www.bwmag.in*

**Here's something unique that we are building for you:**
***www.brainwave-edu.com***

**Get to see behind the scenes:**
***www.facebook.com/brainwavemag***
***www.brainwave-edu.blogspot.in***

# Cricket's our religion

India is a vast country,
People are different, and cultures aplenty.

Everyone is busy and gives a scratch,
Till of course, there's a cricket match!

Sachin Tendulkar is the supreme batsman,
Making Indians proud on more than one occasion.
Over 34000 runs he has scored in all,
This man's blessed, his records stand tall.

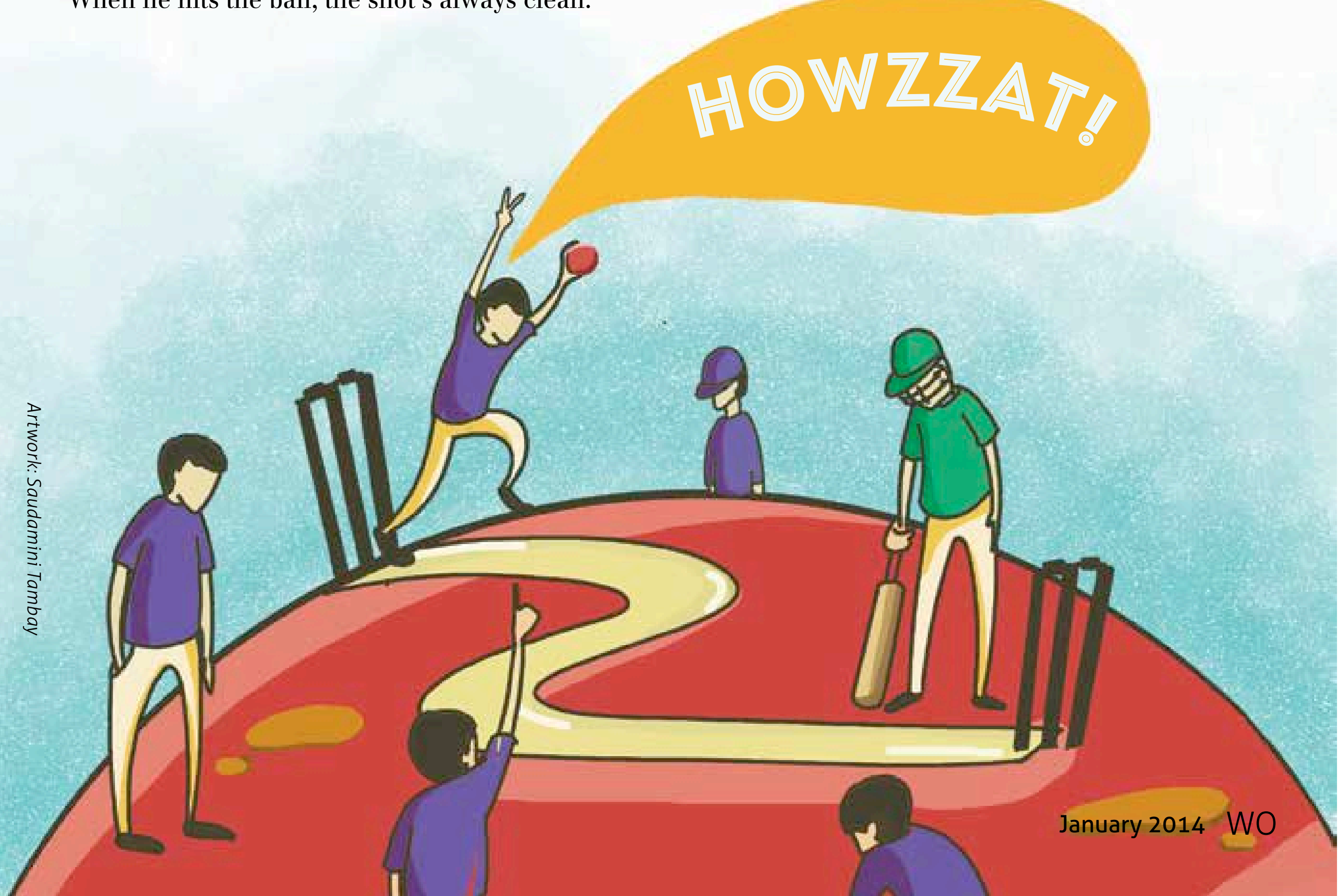
Rahul Dravid is the true team player,
He's the 3rd highest run scorer in Test cricket -
quite a stunner!
Let us tell you this, his fielding skills are no less,
In test cricket, he holds the record for the most
number of catches!

Dhoni is the current captain of the team,
A knight in shining armor he is indeed!
He's the first captain to win all the ICC trophies,
When he hits the ball, the shot's always clean.

Yuvraj Singh is a fighter, known by one and all,
A youth icon, he has battled many a tricky ball.
He is best known for the 6 sixes he hit in an over,
Of the 2007 world Twenty20 and 2012 world ODI
cups, he is a top performer.

The 25-year old Virat Kohli is a miracle,
At such a young age, he reached many a pinnacle.
He's the quickest to score 17 ODI hundreds ever,
Also to reach 5000 ODI runs, he is the fastest
cricketer!

Then are Dhawan, Shami and Unmukt chand,
And the list could go on and on, and never end.
'cause cricket is our religion, a fact known to all,
On match days, all stop work and have a ball.
Cricket brings us together in more than one way,
As Indians live cricket every single day! ■



Artwork: Saudamini Tambay

BORN TO BE ME

*Follow the voice inside,
the voice that makes you one of a kind.*

CELEBRATING YOUR UNIQUENESS.

**Scan with your smartphone &
join us on facebook/classmate**

Email us at classmate@itc.in or call 1800 425 3242

classmate

**BECAUSE YOU ARE ONE OF A KIND**

ztzv No. MAHENG/2012/42382

PARLE®
Melody Cool Tattoo Offer!
A stylish range of crazy-cool tattoos is here! Get one tattoo free with two Parle Melody toffees. Wear them, like you wear your attitude and bling it on.
Collect them all - the more you get, the better your style!
Melody
Chocolaty
FREE TATTOO
Melody khaao
AUR KHUD KA STYLE DIKHAAO
everest/PB/276-13
Offer valid till stocks last. Stocks also available without this offer.

## WHAT IS BRAINWAVE?

Brainwave is a children's science magazine from the house of Amar Chitra Katha and Tinkle.

We understand that each child has a different aptitude and love for science. Hence, we simplify science into forms that excite them - comics, stories, fun-do activities, contests and fascinating facts.

**Give your child a Brainwave, and science will be just another game!**